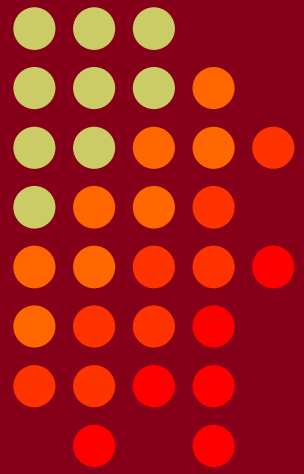
Everything You Need to Know About USB and Serial Interfaces

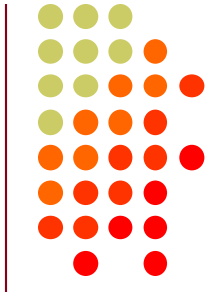
Presented by N6TV

n6tv@arrl.net



CTU CONTEST UNIVERSITY

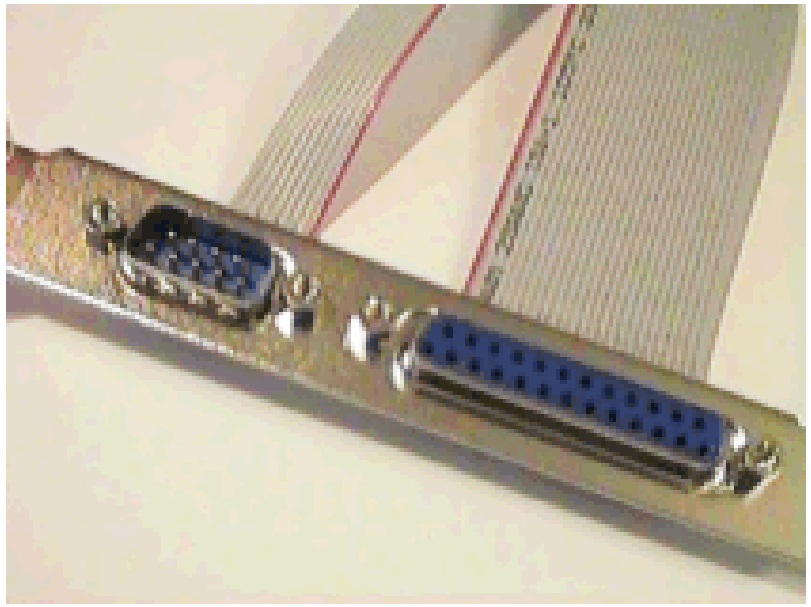
Presentation Overview



- Legacy PC Serial Ports
- USB Ports and Devices
- USB-to-Serial Adapters
- Using the Device Manager
- Managing Serial Port Numbers
- Using Serial Ports for CW / FSK / PTT Keying
- Sharing Serial Ports
- USB Sound Cards
- Q & A

Legacy PC Serial Ports

- Originally a 25-pin male D-SUB connector (DB-25M), used with dial-up modems
- Smaller 9-pin male serial connector became standard (DE-9M) for serial, DB-25F for printers

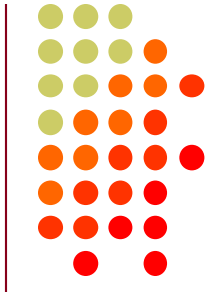


Life was Simple

- One or two male DE-9 connectors on PC
- Accessed as COM1: or COM2:
- One DE-9 “CAT” or “RS232” connector on radio
  - Female: Elecraft IC-7700 & IC-7800

  - Male: Yaesu Kenwood

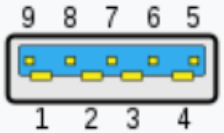
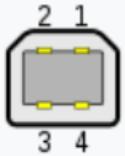
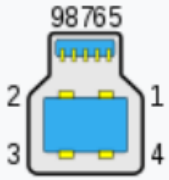
Computers “Improved”



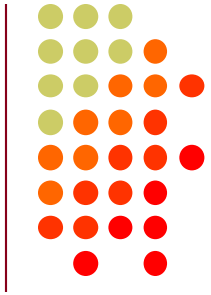
- “Real” serial and parallel ports disappear, replaced by USB ports
- Notebook computers: PCMCIA, PC Card, ExpressCard slots for serial adapters disappear
- Radios (until recently) still had 9-pin serial ports
- Peripherals are still using 9-pin serial ports
  - Rotator controllers, SteppIR antenna controllers, some band decoders, etc.
- Common Solution: USB-to-Serial adapters

USB 2.0 and 3.0 Ports

- Standard connector on most PCs and MACs

PC:	Type A  Type-A	Type A  Type-A SuperSpeed
Radio:	Type B  Type-B	Type B  Type-B SuperSpeed

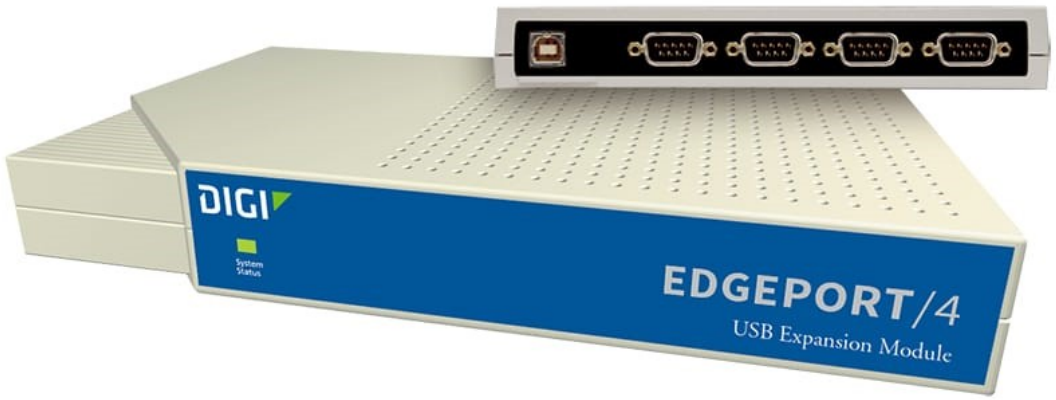
USB-to-Serial Adapters



- Reliability and Compatibility Varies Greatly

1. Edgeport – Excellent, stable, supports MMTTY directly
2. Eltima – Included with microHAM interfaces
3. FTDI – very good, stable, requires EXTFSK for MMTTY. Used internally by Elecraft K3.
4. Silicon Labs (built in to Icom, Kenwood, Yaesu)
5. Prolific – **AVOID!** Uninstall drivers, recycle.

Digi International Edgeport/4



- One USB 2.0 Type B connector
- Four independent DE-9M serial ports
- Windows automatically finds and installs drivers

Digi International Edgeport/8

- One USB 2.0 Type B connector
- Eight independent DE-9M serial ports
- Windows automatically finds and installs drivers

StarTech.com ICUSB2324I 4-Port FTDI

- One USB 2.0 Type B connector
- Four independent FTDI DE-9M serial ports
- Separate 5V Power Supply

StarTech.com ICUSB2328I 8-Port FTDI

- One USB 2.0 Type B connector
- Eight independent FTDI DE-9M serial ports
- Separate 5V Power Supply

microHAM uses Eltima drivers

microHAM MK2R+

- One USB Type B connector
- Custom Eltima serial port device drivers
- Custom cables for transceiver ports
- Virtual serial ports created by microHAM “Router”

Recommended FTDI USB-to-Serial Adapters

FTDI CHIPI-X10 - $15

FTDI Chip

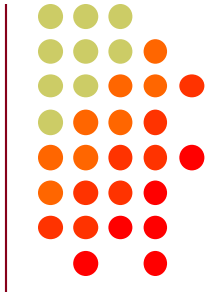
GearMo 2-port - $30

GearMo 4-port - $40

Prolific USB-to-Serial Adapters

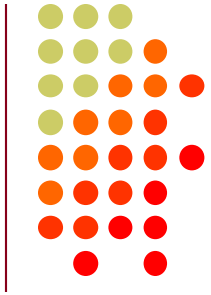
- Widely available, cheap (but many counterfeits)
- Device Driver does not play well with others
- Please DO NOT USE them, ever
- Uninstall any Prolific device drivers with Device Manager
- Devices often look like this:

Connecting USB-to-Serial Adapters



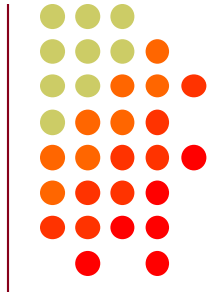
- Connect FTDI, Elecraft, or Edgeport device to PC
- Windows (usually) locates and installs appropriate device driver(s)
- COM ports assigned sequentially
- Use Windows Device Manager to view assigned COM Port number

Connecting USB Radios / Devices



- Important: Install the manufacturer's device driver first, *then* connect the device
  - Icom, Kenwood, Yaesu, microHAM
  - Usually not required for Elecraft (FTDI)
- If you forget and connect radio first, use Device Manager to uninstall "Unknown Device", then start over
- COM port numbers assigned sequentially

Using the Windows Device Manager

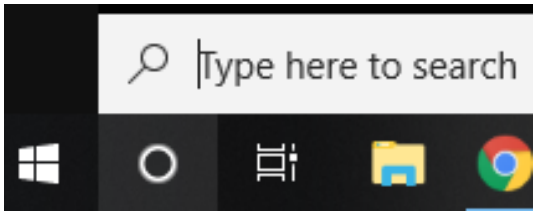


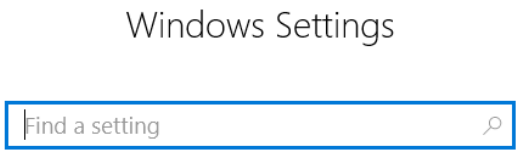
- **Right click** on Windows **Start** Button 
- Click **Device Manager**

  -or-
- Run: **devmgmt.msc**
- Important Tip: Always set the System Environment Variable **devmgr_show_nonpresent_devices** to **1**

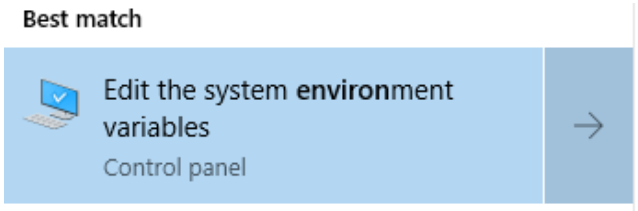
Setting System Environment Variable

- Type “Environment” in Windows Search box or Windows Settings Search box

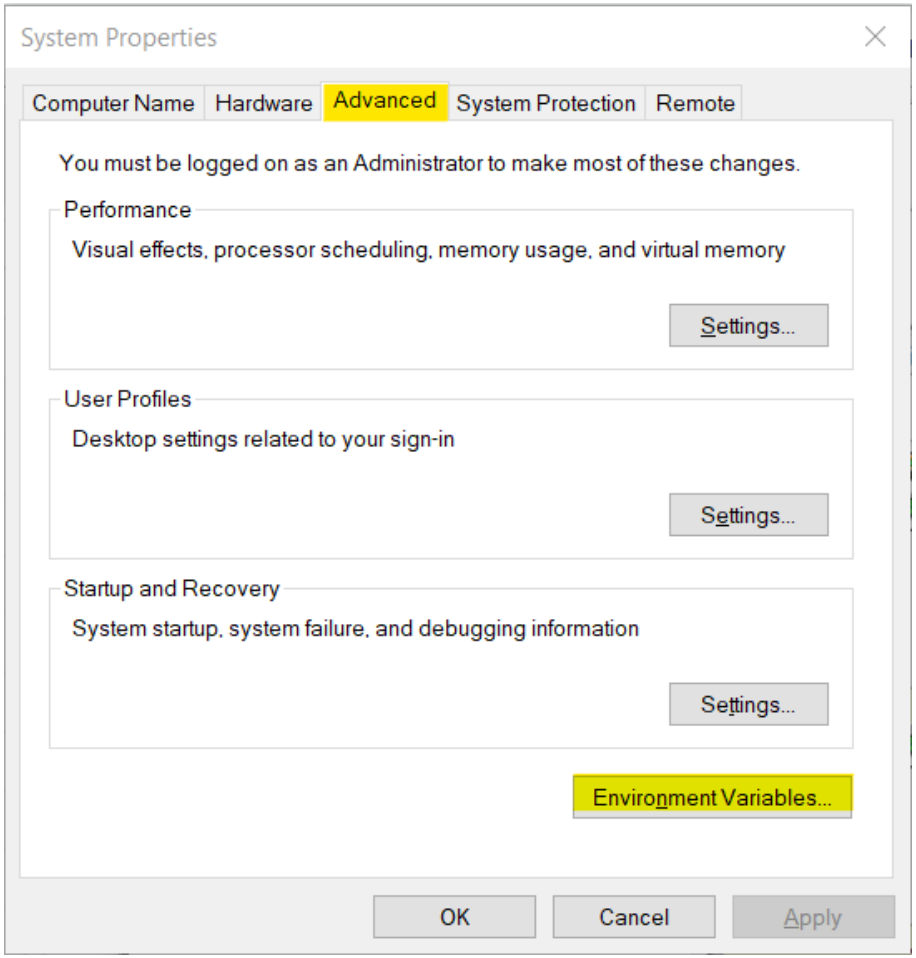




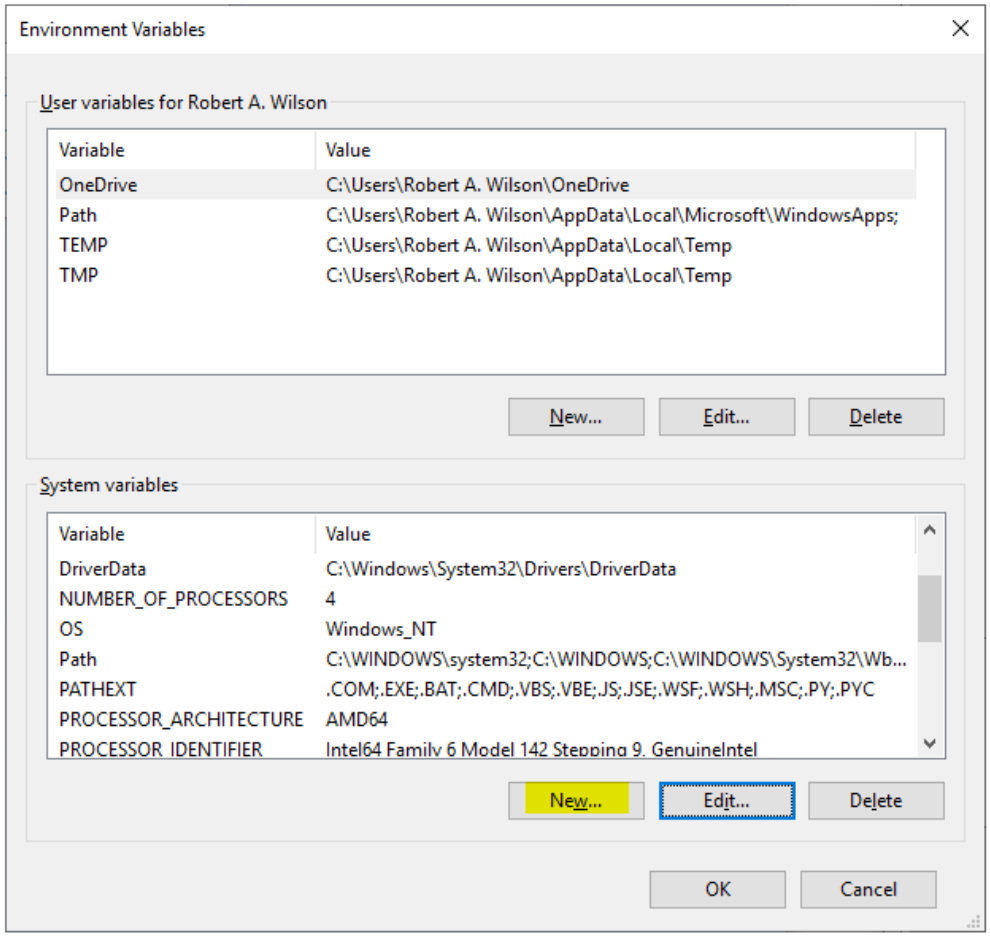
- Click “Edit the System Environment Variables”



Step 1 – Under Advanced tab click Environment Variables…

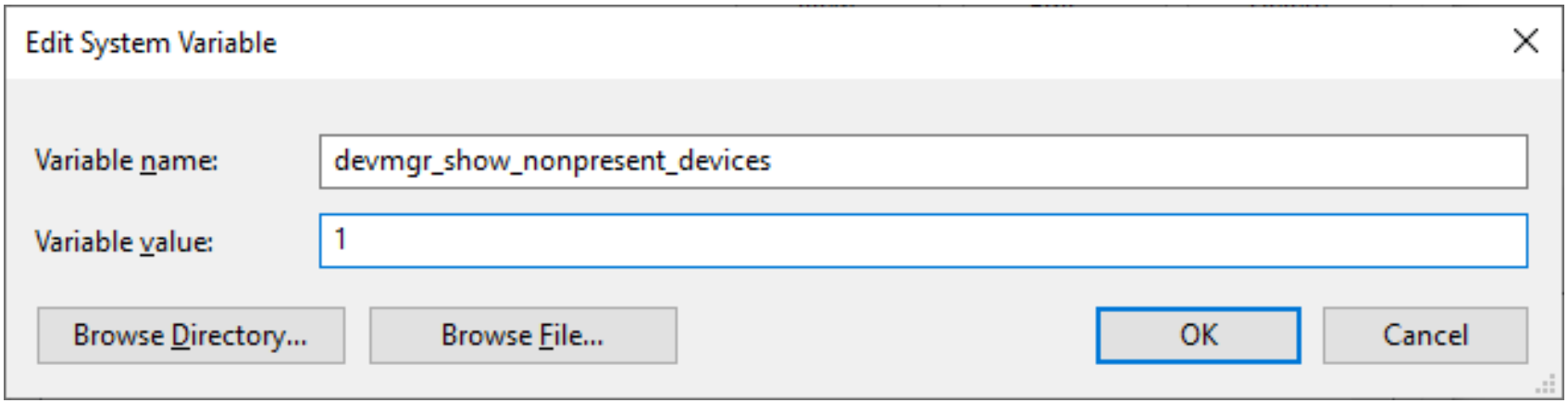


Step 2 – Under System variables, click New…



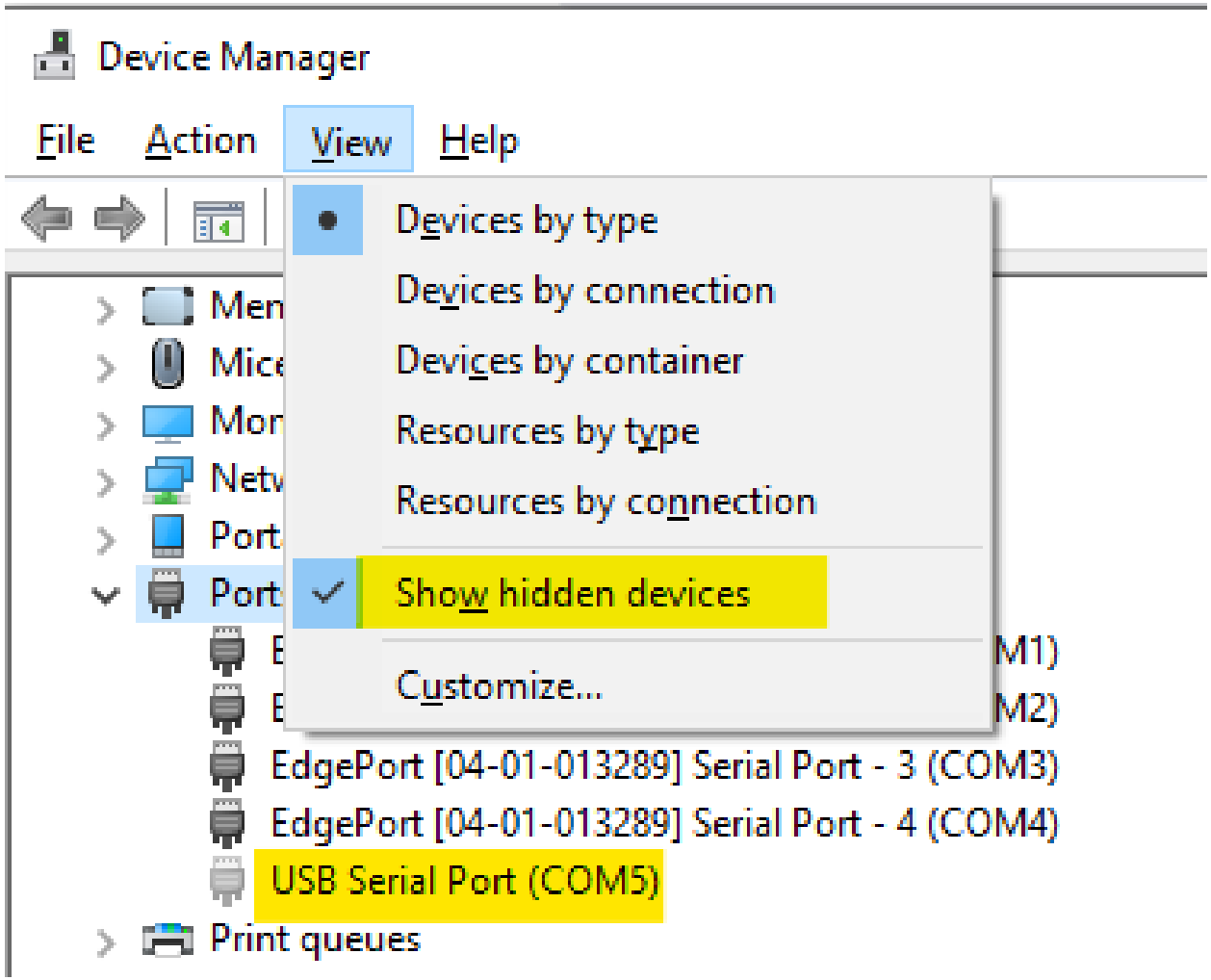
Step 3 – Add the new environment variable

Name: **devmgr_show_nonpresent_devices**
Value: **1**

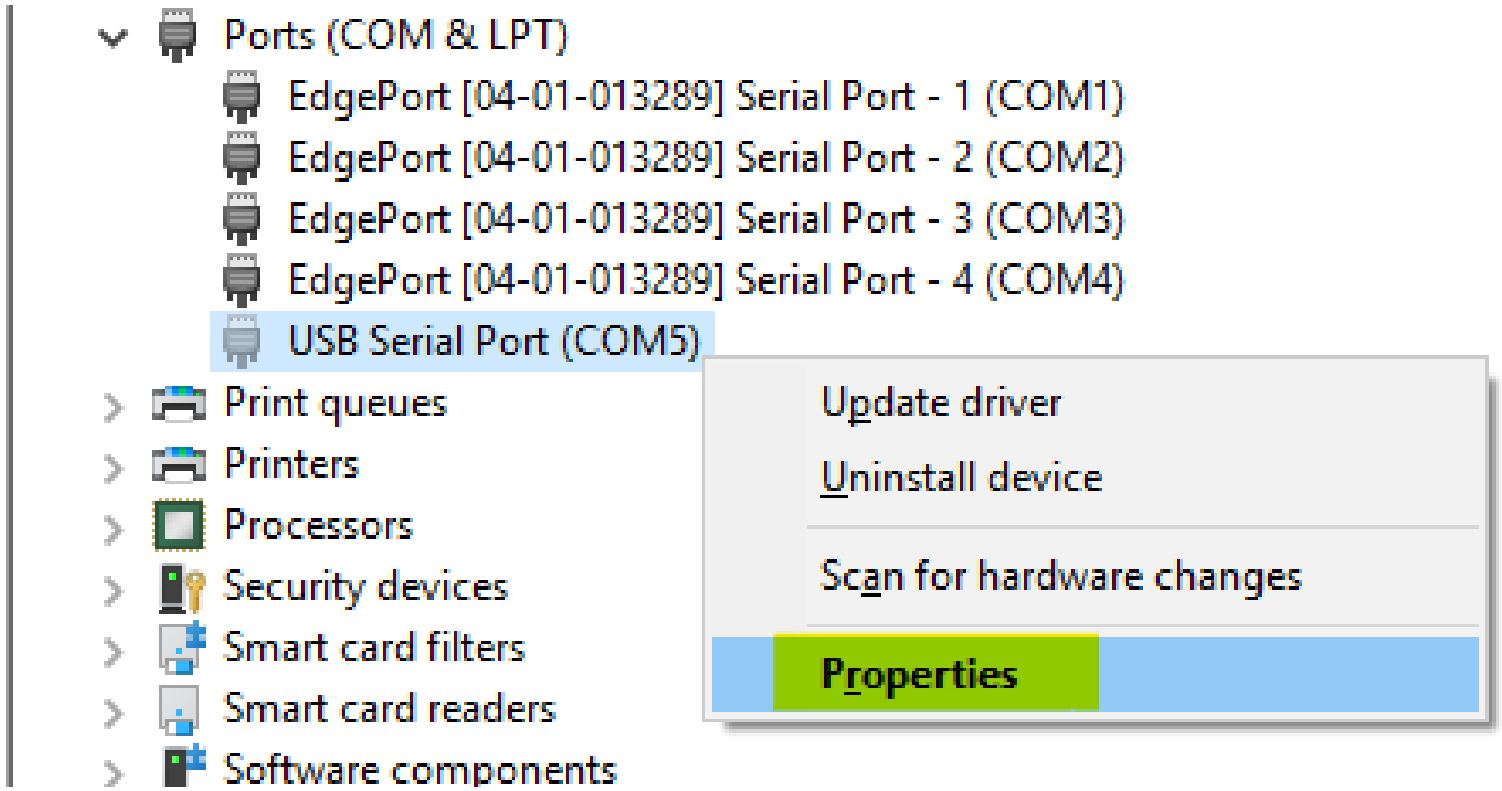


Click **OK**, then start Windows Device Manager

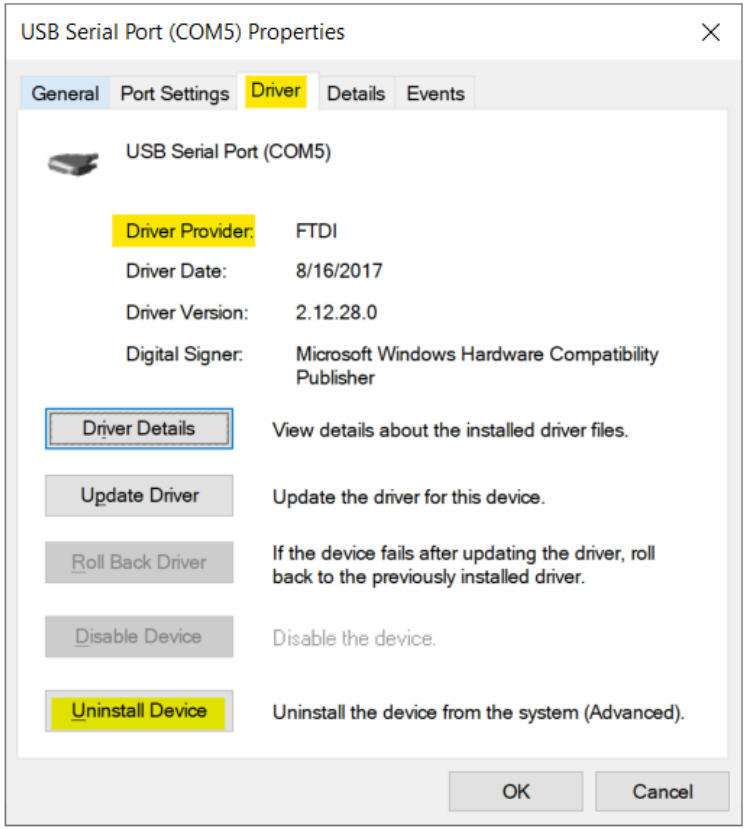
Step 4 – in Device Manager:
Select View → Show hidden devices



Expand Ports section
Right click offline devices, Properties

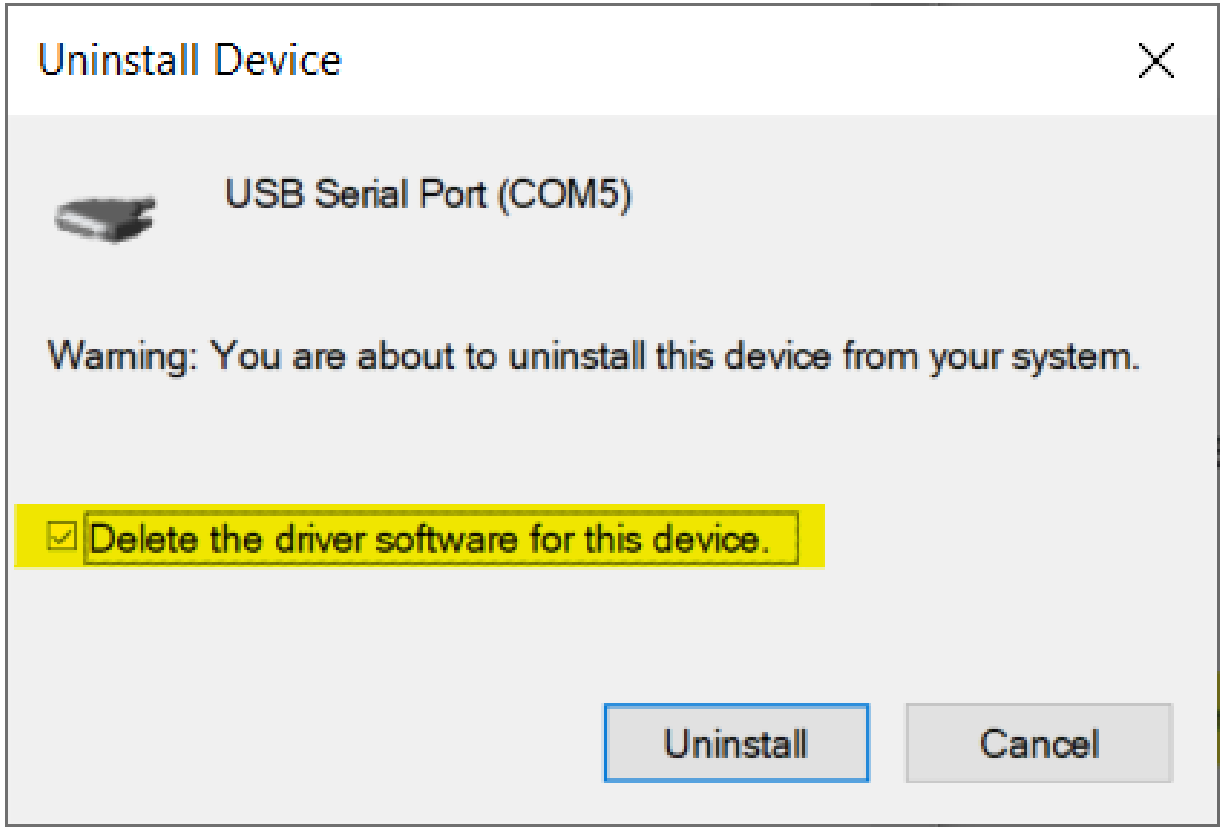


Click Driver Tab
Check that Driver Provider is not Prolific

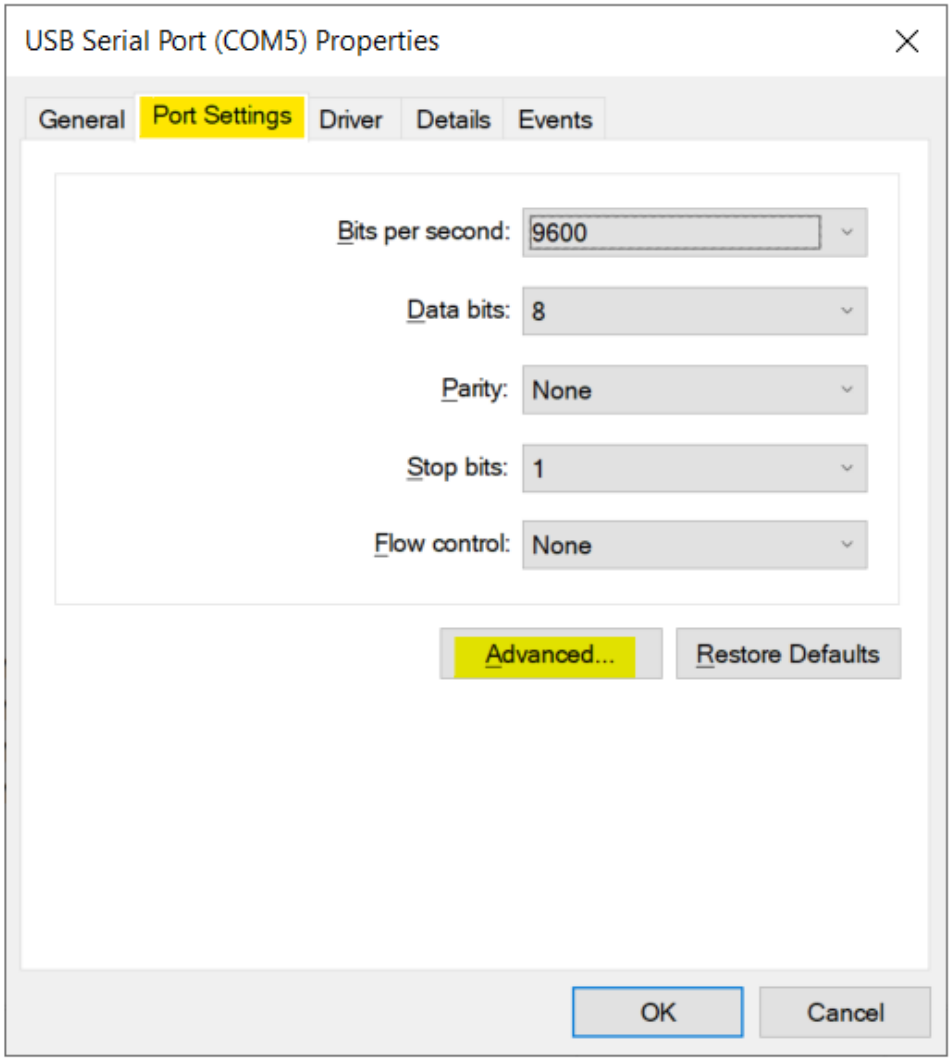


- If you see **Prolific**, click **Uninstall Device**

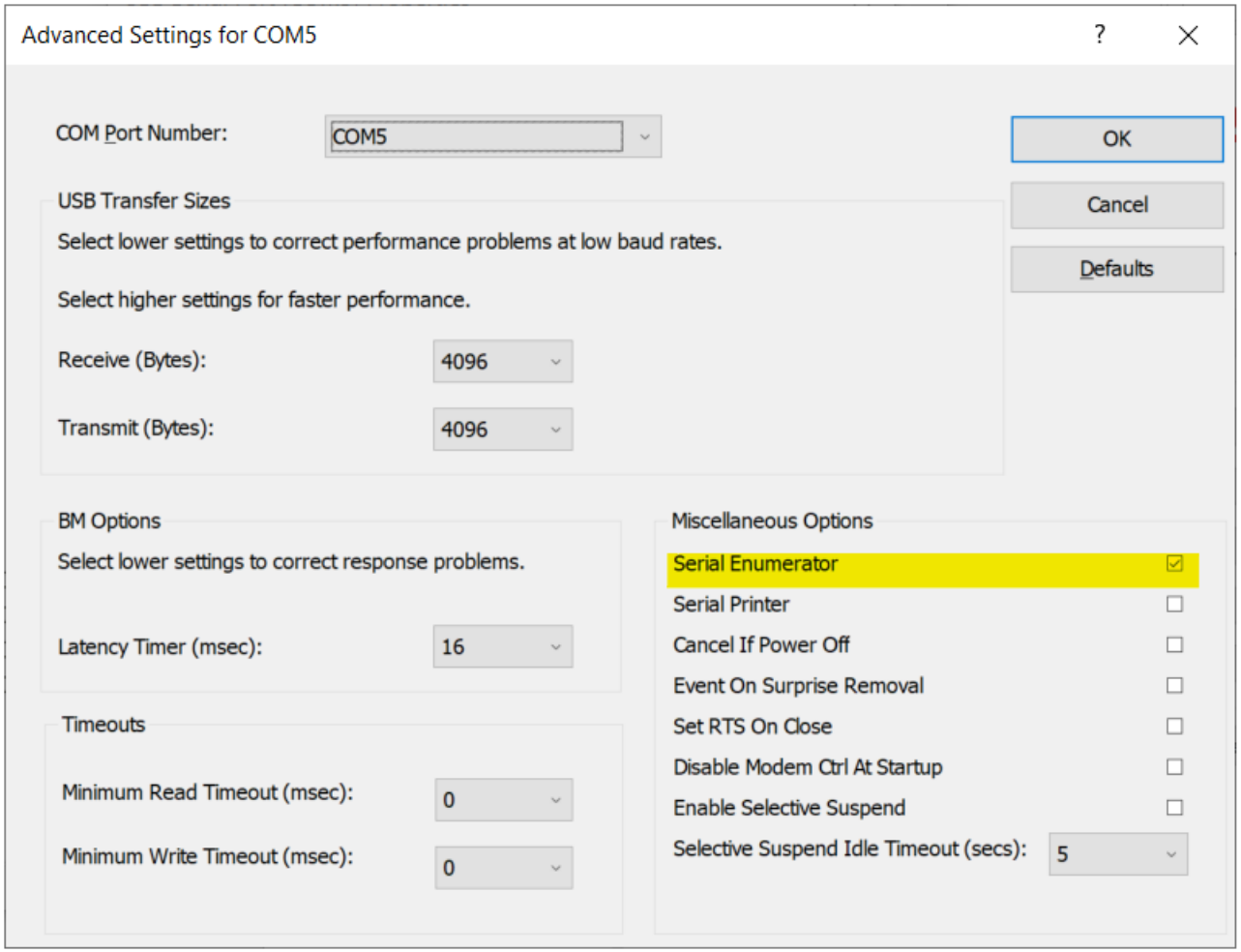
Uninstall the Prolific Device AND Delete the Driver Software



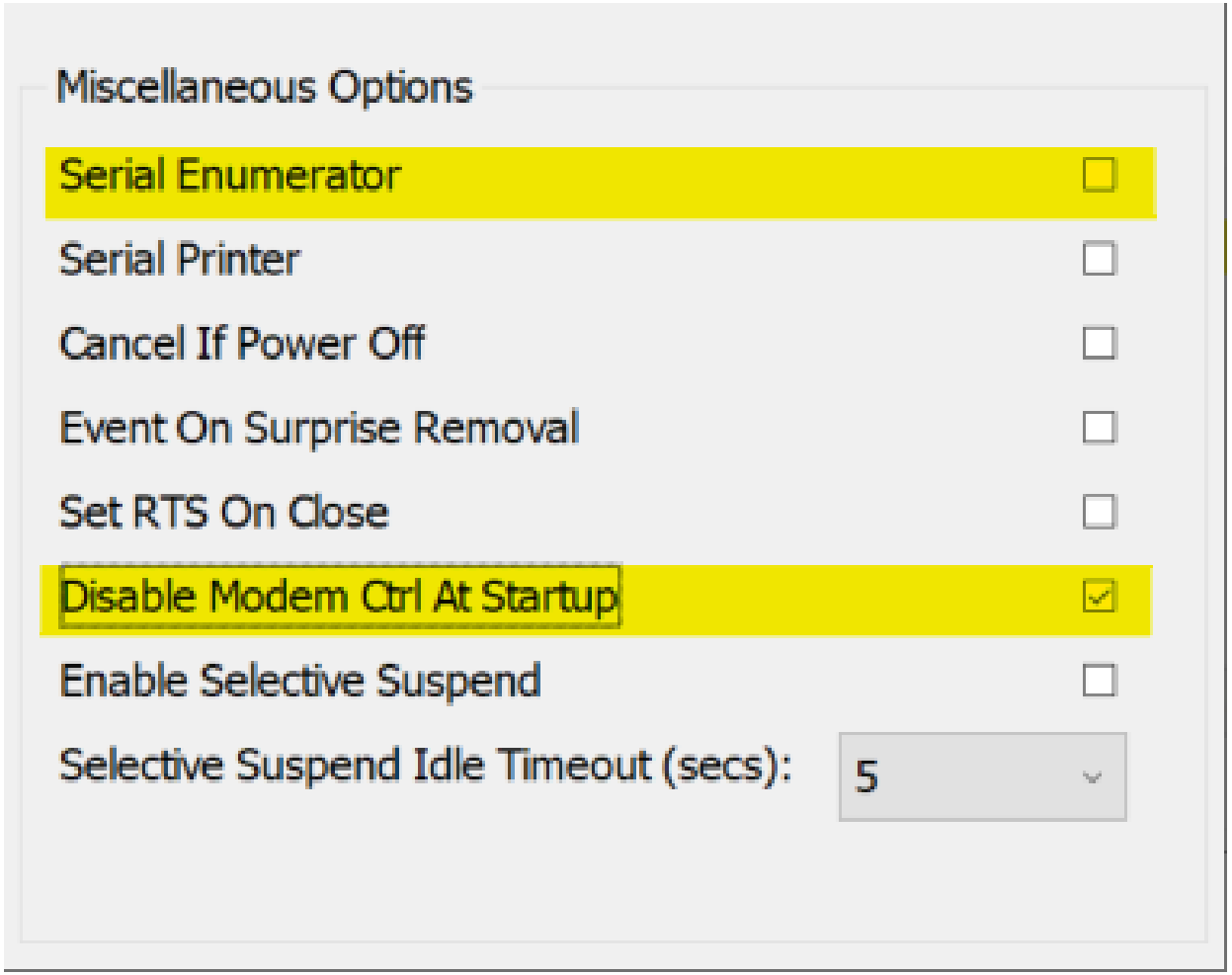
If Driver is FTDI, go to Port Settings tab
Click Advanced… button



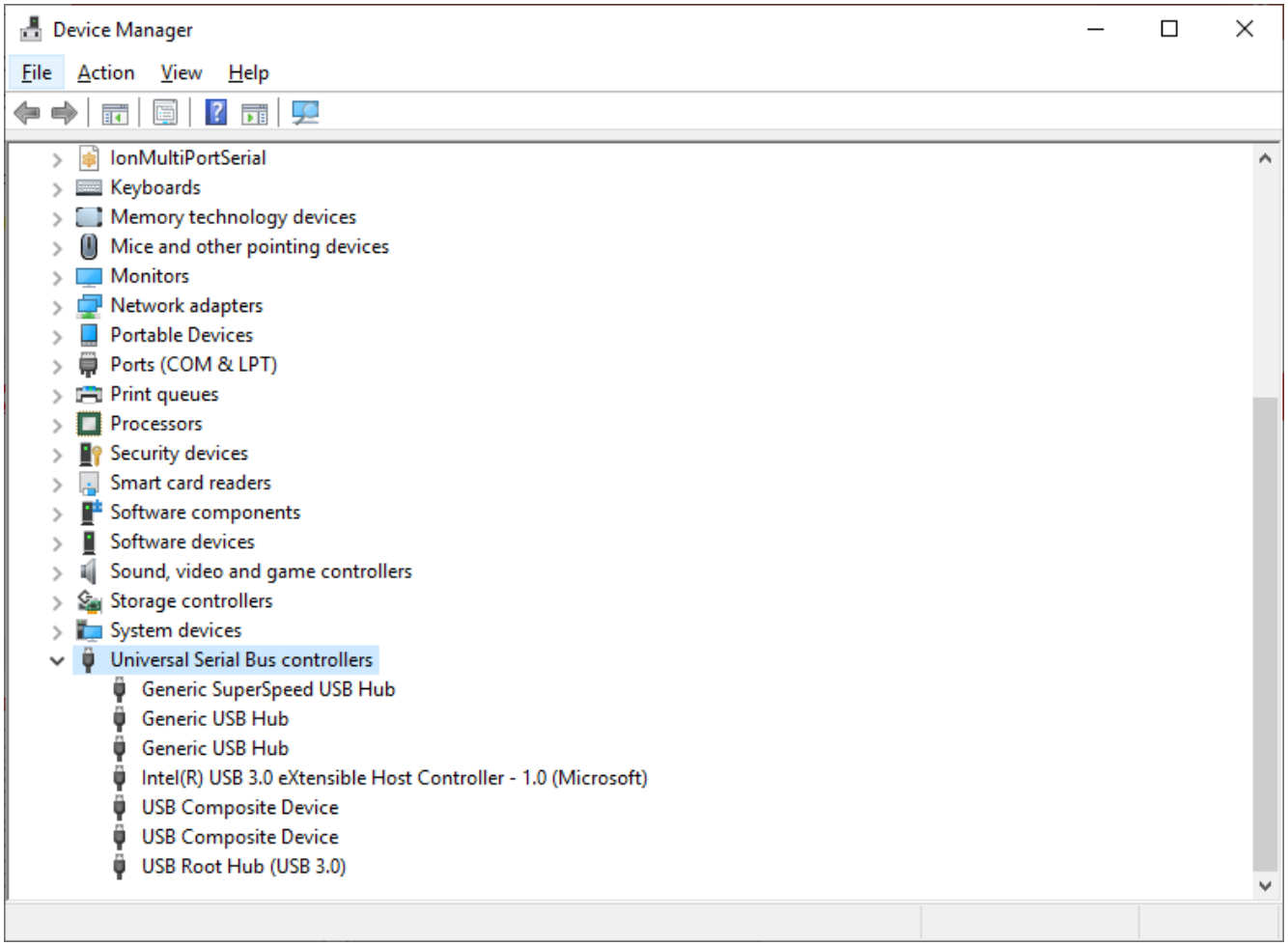
FTDI Default Options – not good



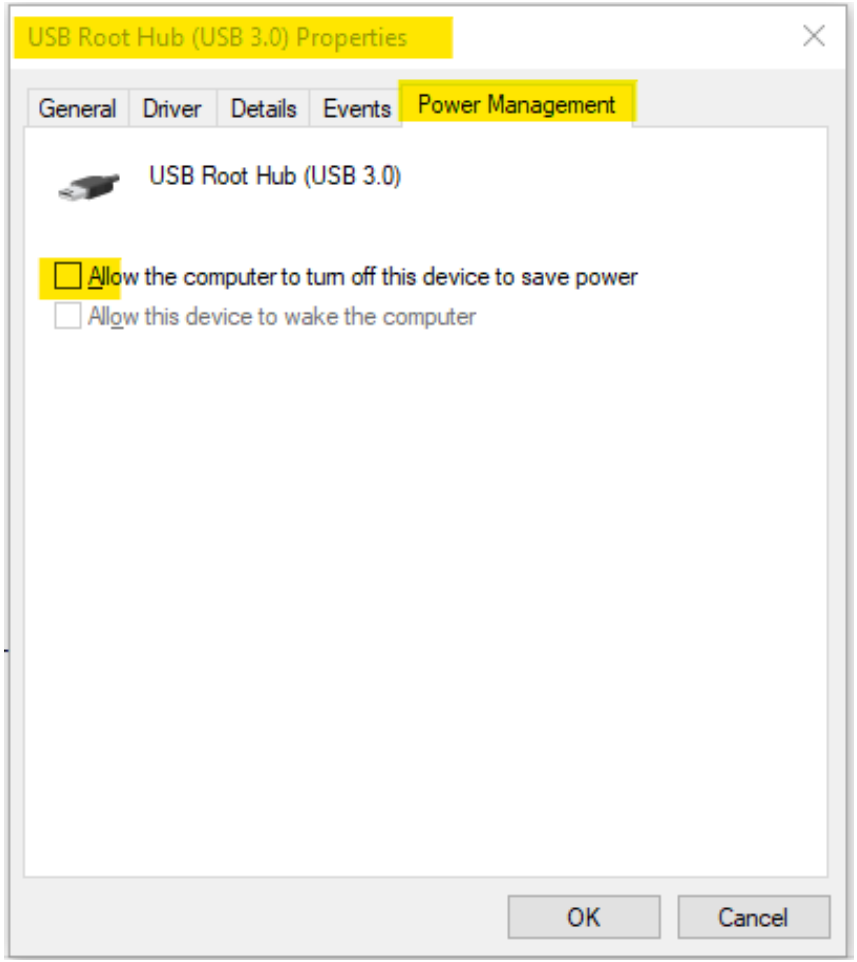
Change the FTDI Options To This



Under USB Serial Bus Controllers: Right-Click each, Select Properties

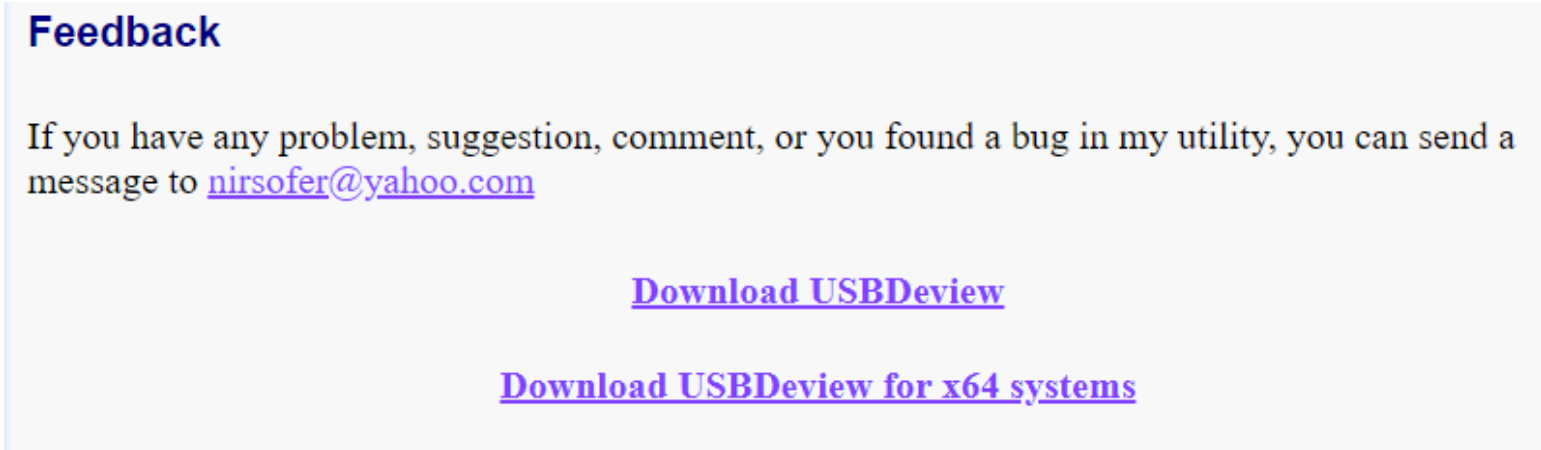


Look for Power Management Tab
Do not allow computer to turn off



Another USB Dev. Management Tool: NirSoft's USBDeview

- Stands for USB Device View
- https://www.nirsoft.net/utils/usb_devices_view.html
- Scroll Way Down to the "Feedback" section to find download link:



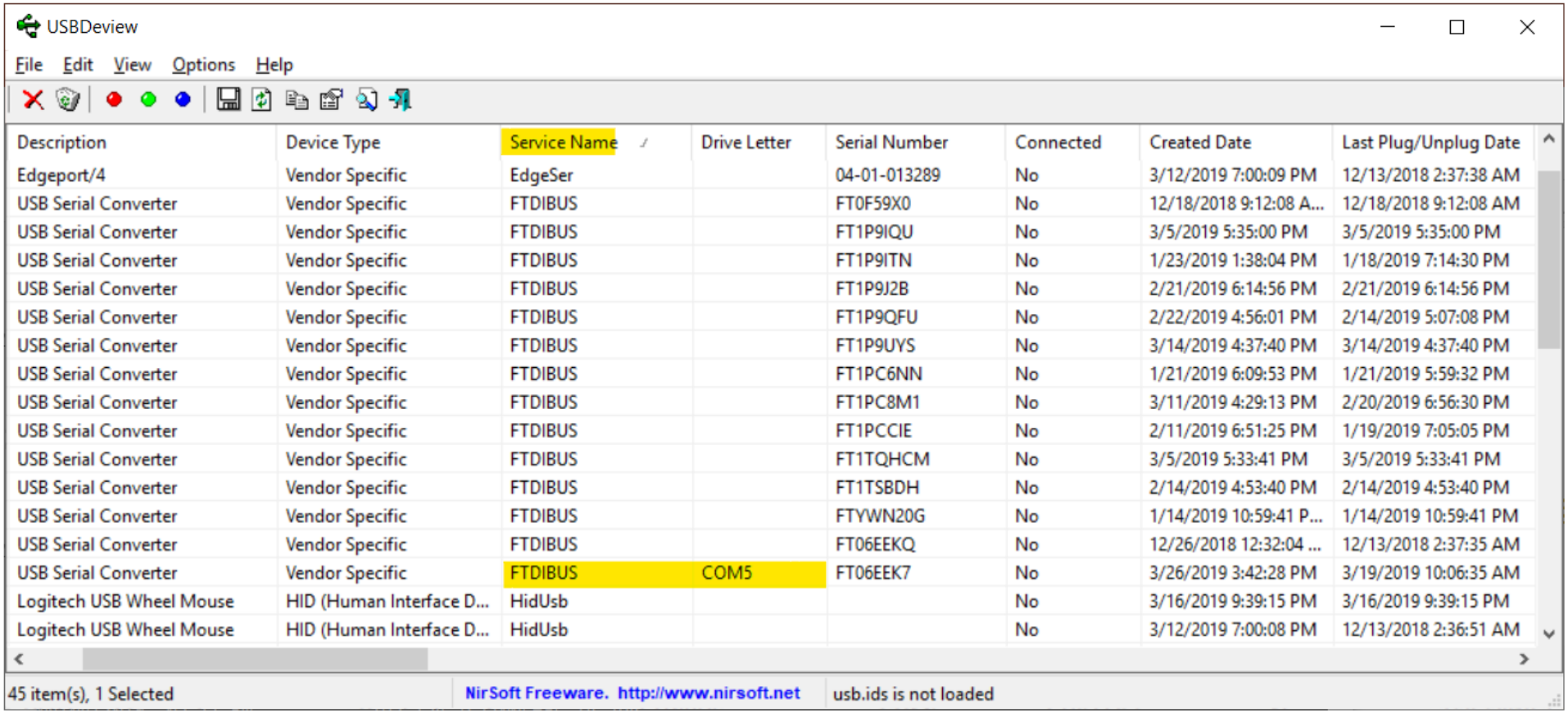
Feedback

If you have any problem, suggestion, comment, or you found a bug in my utility, you can send a message to nirsofer@yahoo.com

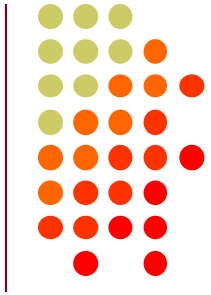
Download USBDeview

Download USBDeview for x64 systems

USBDeview Screen Shot

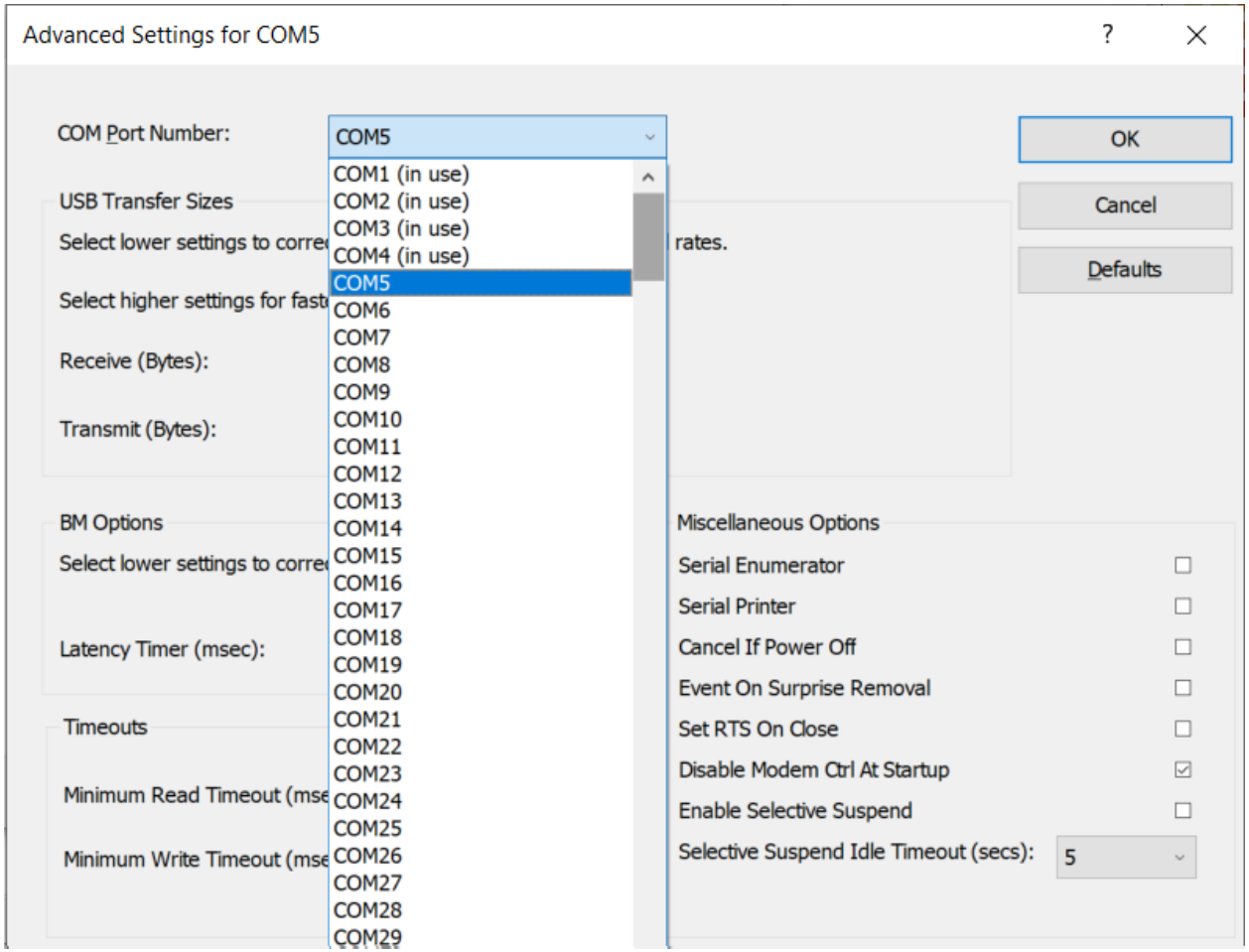


Managing COM Port Numbers



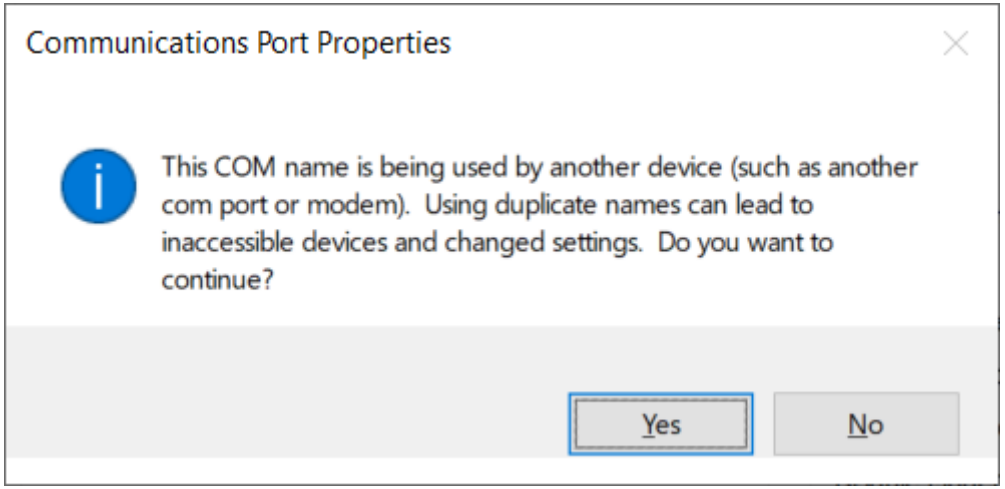
- Over time, ever increasing unique COM port numbers are assigned by Windows, difficult to keep track
- Some software doesn't support COM13: or higher
- Suggestion: renumber serial ports "left to right" to match your station layout, starting with transceivers
- First, use Windows Device Manager to uninstall all serial devices that you no longer use
- Right click on remaining COM ports, Properties, **Port Settings** tab. Click **Advanced…** button
- Renumber ports sequentially, COM3:, COM4:, COM5:, etc., "left to right"

Renumbering Serial Ports

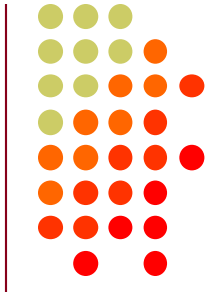


What does “In Use” Mean?

- It means this COM port number was assigned to some device, maybe years ago
- It usually does *not* mean that you can’t use it during reassignment, especially if it is “grayed out” (hidden)
- Uninstalling disconnected devices first will help
- Usually safe to ignore this warning and click YES:

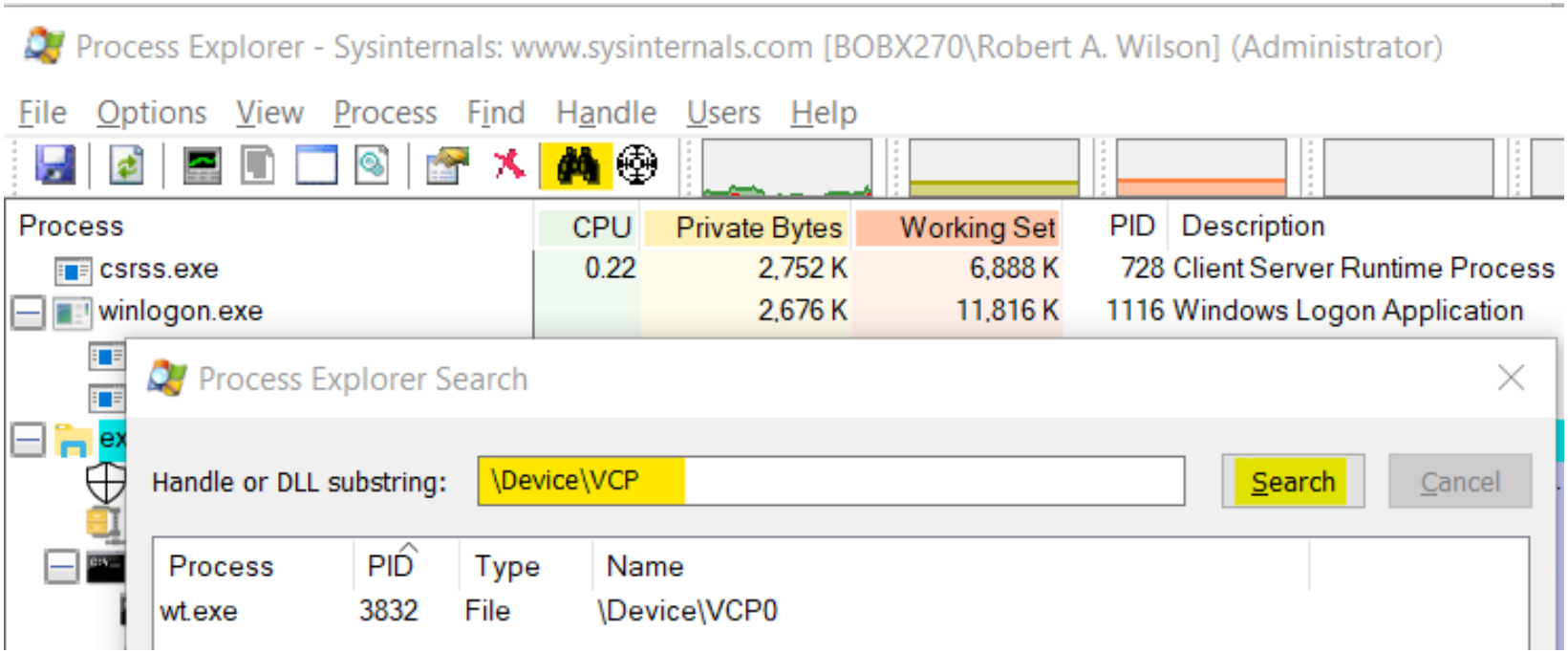


What program is currently using my serial port?



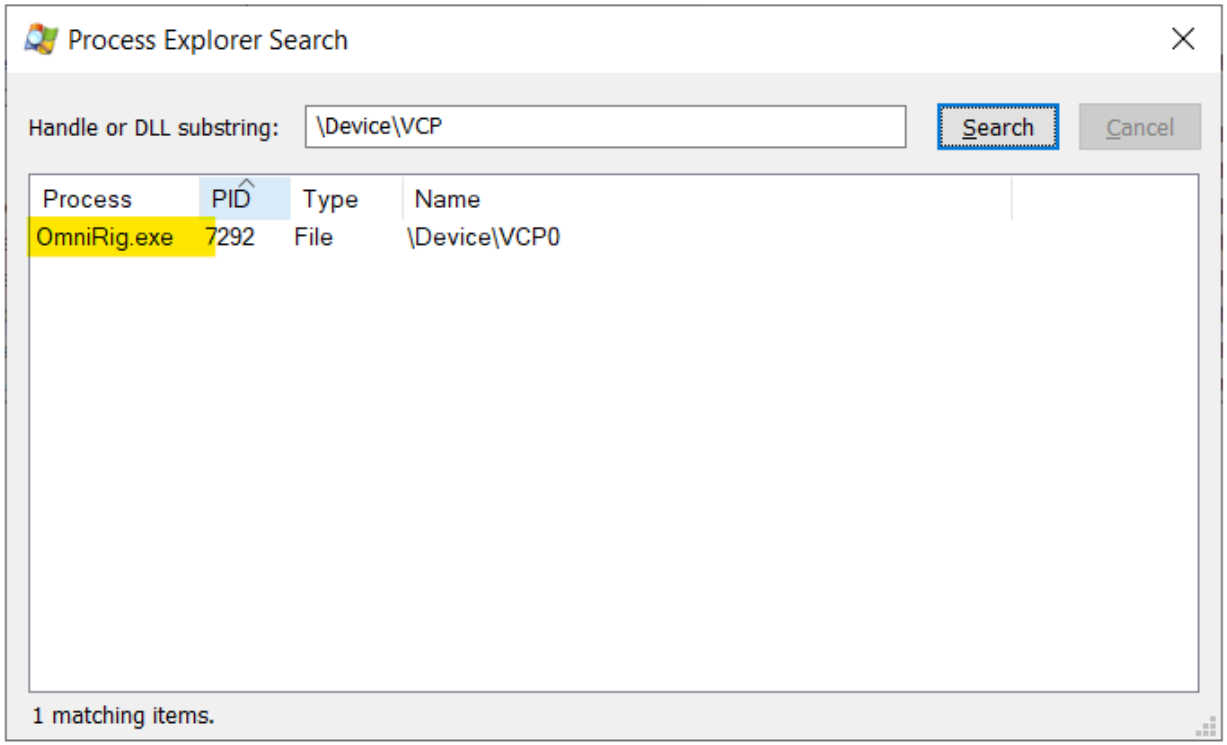
- Use Windows Process Explorer
- https://docs.microsoft.com/en-us/sysinternals/downloads/process-explorer
- On Windows 10, run **procexp64.exe** as **Administrator**
- Click Search button (binoculars icon)
- Enter one of the following partial search strings
  \Device\VCP - FTDI virtual serial ports
  \Device\Edg - Edgeport virtual serial ports
  \Device\Ser - Hardware serial ports
  \Device\Sil - Icom/Kenwood/Yaesu Silicon Labs ports

Search Example 1



Win-Test (wt.exe) has opened the FTDI Serial Port

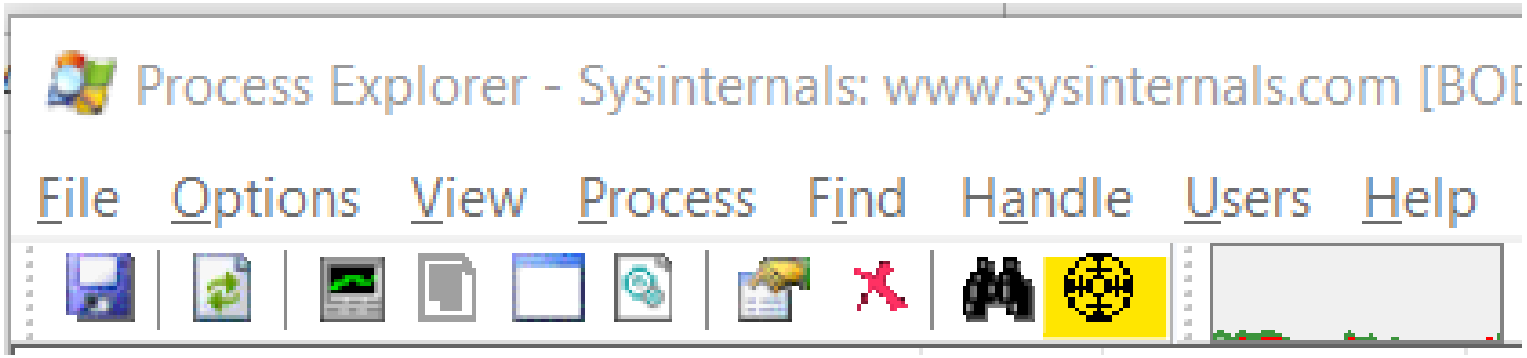
Search Example 2



OmniRig (e.g. WSJT-X, Log4OM) has opened the FTDI Serial Port

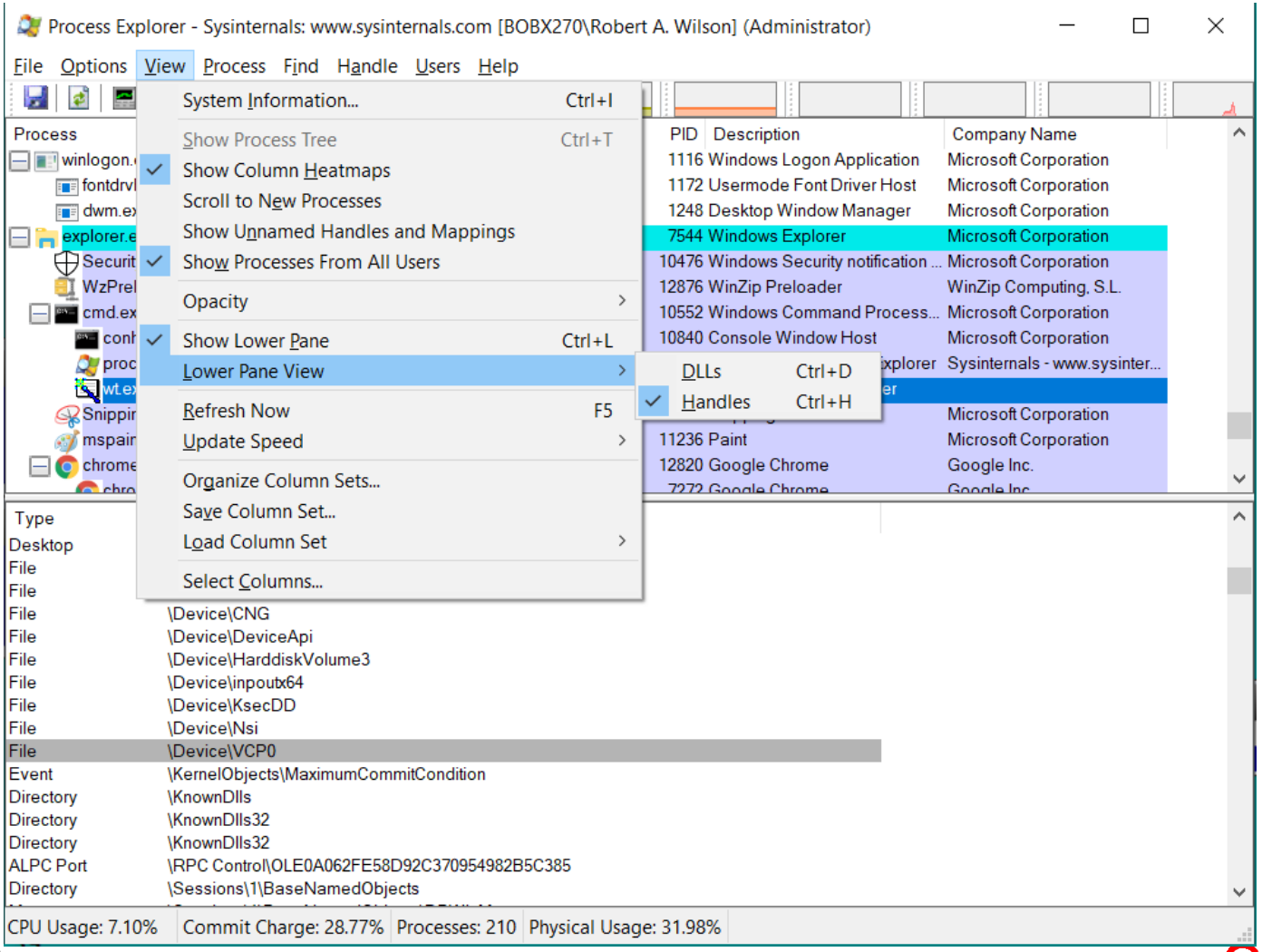
Not sure what to search for?

- Open a program known to use a particular serial port
- In Process Explorer, *drag* the “Find Windows Process” icon on top of the program window



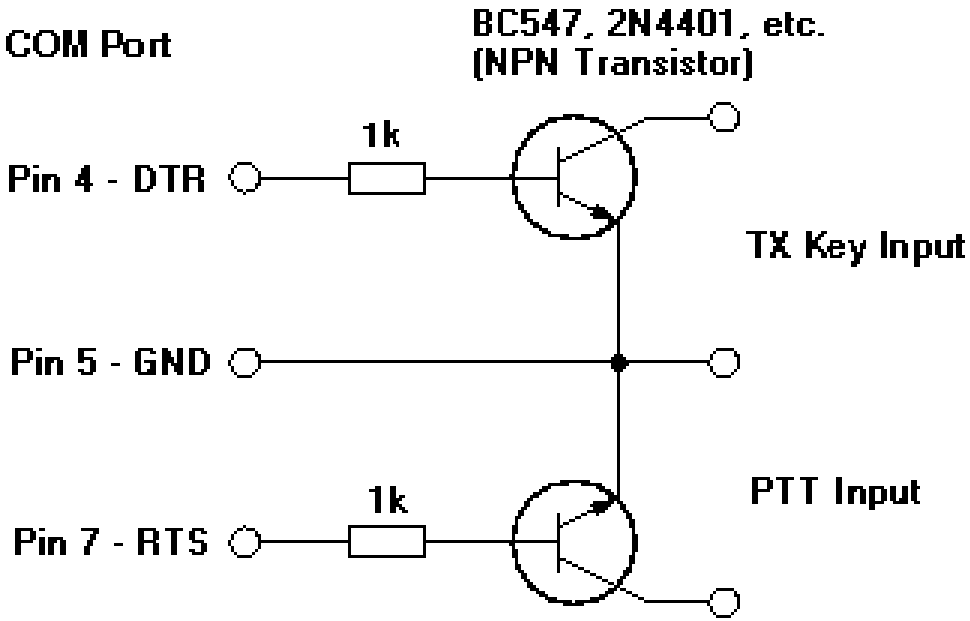
- Process Explorer will jump to the process corresponding to that program window

Select View, Lower Pane View, Handles, then sort by Name

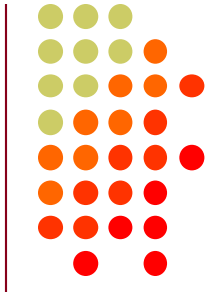


Computer CW, PTT, and FSK RTTY Keying Using Serial Port pins (DTR=CW, RTS=PTT)

- A simple hardware keying circuit, used for decades:



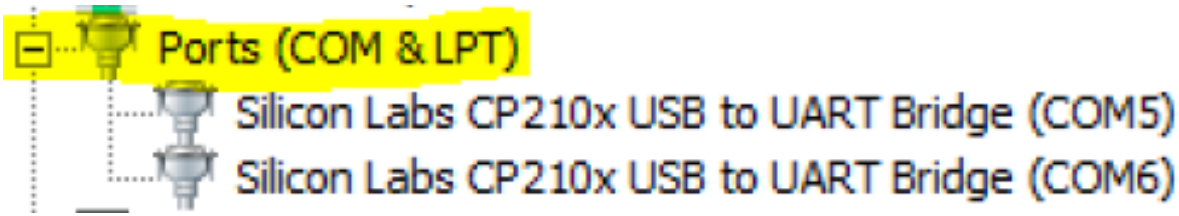
Elecraft K3 / K3S keying via serial port



- First transceiver to include computer keying circuit *inside the radio*
- Does not use RTS and DTR pins for RS232 “Handshaking”, freeing them for other purposes
- In K3, set **CONFIG:PTT-KEY** to **RTS-DTR** (vs. **OFF-OFF**)
- Works the same over a standard serial cable (CONFIG:RS232 = 38400) or the K3S USB connection (CONFIG:RS332 = USB)
- To prevent unwanted transmissions when PC reboots, change FTDI Port Settings:
  - Uncheck “Serial Enumerator”
  - Check “Disable Modem Ctrl At Startup”

ICOM Copies Elecraft, Adds FSK Keying

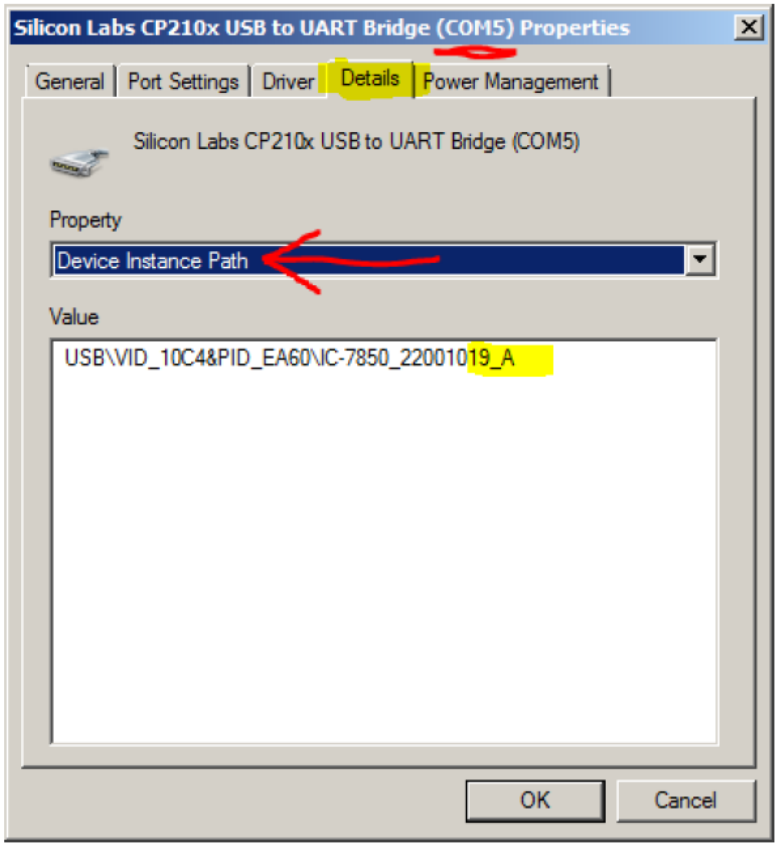
- CW, PTT, and FSK keying OK over USB virtual serial port
- Supported by IC-7300, IC-7610, IC-7850, IC-7851
- IC-7300 generates just one virtual serial port
- IC-7610, IC-7850, IC-7851 generate *two* virtual serial ports:



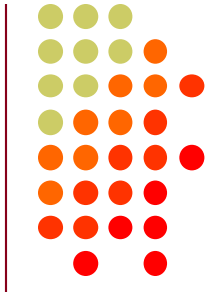
- To keep it simple use DTR pin for keying, RTS pin for PTT
- Use port “B” for MMTTY exclusively
- Mnemonic: **C**W : **D**TR : **F**SK • **P**TT : **R**TS : **S**end

ICOM: Determining COM Port A and B

- Use Windows Device Manger, right click on first COM port, Properties, Details tab, Device Instance Path, check last letter



ICOM IC-7300

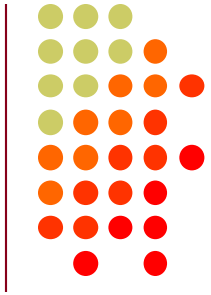


- USB cable provides *one* virtual serial port
- In IC-7300 **SET > Connectors** menu:
  Set **USB Keying (CW)** to **DTR**
  -or-
  Set **USB Keying (RTTY)** to **DTR**
- Set **USB Send** to **RTS**
- Logging Software, rig control Port (USB), set DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **EXTFSK64** to select COM port. Cannot use logger at same time; rig has just one serial port.

ICOM IC-7610

- USB cable provides *two* virtual serial ports
- In IC-7610 **SET > Connectors > USB Send/Keying**:
  Set **USB Keying (CW)** to **USB1(A) DTR**
  Set **USB Keying (RTTY)** to **USB1(B) DTR**
  Set **USB Send** to **USB1(A) RTS** or **USB1(B) RTS**
- In Logging Software, rig control COM Port (A):
  DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **ESTFSK64** to select second COM Port (B):
  FSK=DTR, PTT=RTS

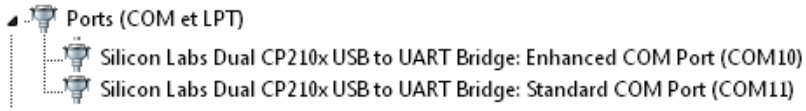
ICOM IC-7850, IC-7851



- USB cable provides *two* virtual serial ports
- In IC-785x **SET > Others** menu:
  Set **USB Keying (CW)** to **USB1 DTR**
  Set **USB Keying (RTTY)** to **USB2 DTR**
  Set **USB Send** to **USB1 RTS** (CW) or **USB2 RTS** (RTTY)
- In Logging Software, rig control COM Port (USB1) set DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **ESTFSK64** to select second COM port (USB2)
  FSK=DTR, PTT=RTS

Yaesu FT-991

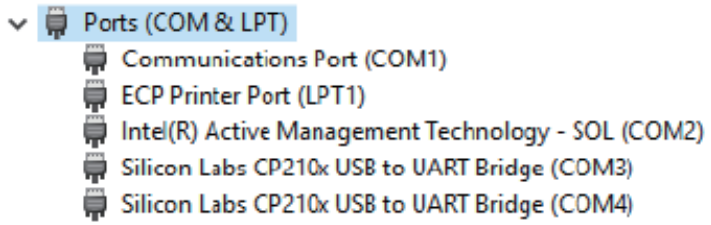
- USB cable provides *two* Silicon Labs virtual serial ports:



- In Yaesu Menu, set
  033 CAT RTS: Disable (Turns off RS232 handshaking)
  060 PC Keying: DTR
  047 AM PTT SELECT: RTS
  071 DATA PTT SELECT: RTS
  076 FM PKT PTT SELECT: RTS
  110 SSB PTT SELECT: RTS
- In Logging Software, rig control is via the “Enhanced” COM Port, CW / PTT via “Standard” COM Port: DTR=CW, RTS=PTT
- In MMTTY, use **EXTFSK** or **ESTFSK64** with the “Standard” COM port: FSK=DTR, PTT=RTS

Kenwood TS-890

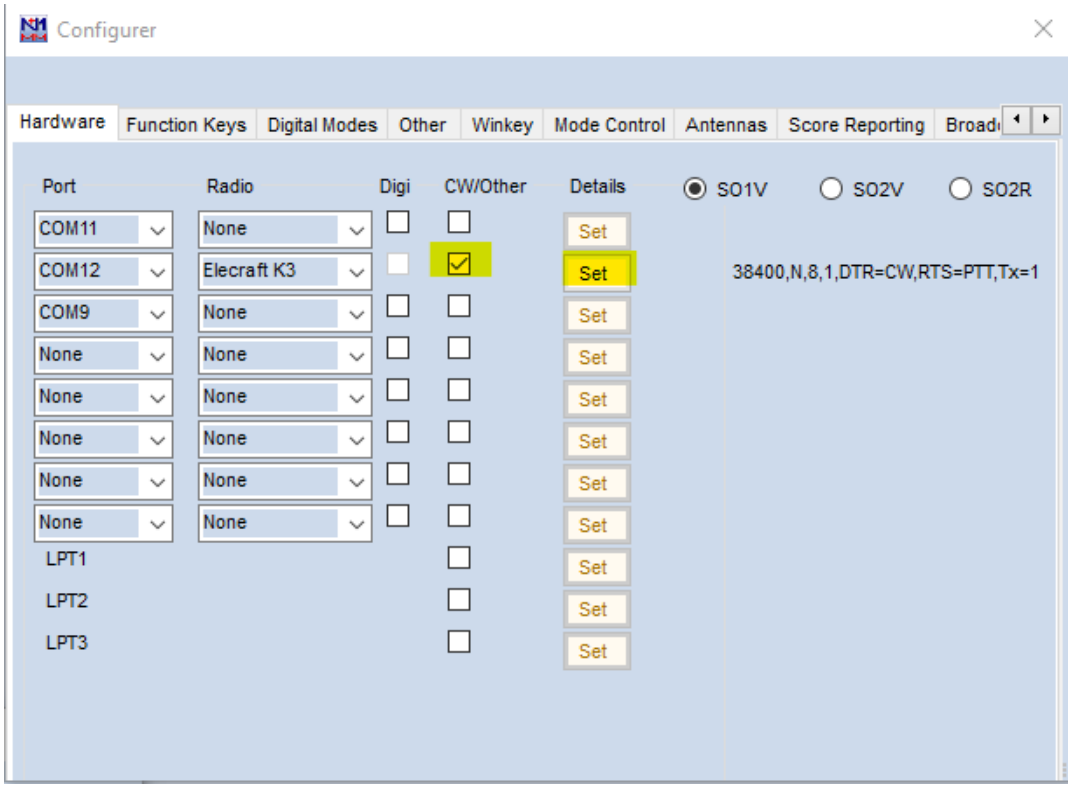
- USB cable provides *two* Silicon Labs virtual serial ports:



- Right click, Properties, Details tab, Location Path:
  USB1 is “Standard” Serial Port, USB2 is “Enhanced”
- In Logging Software, rig control is via the “Standard” COM Port
  CW / PTT / FSK keying may be assigned to DTR or RTS of either port
- **Menu 17 Virtual Standard COM Port RTS: PTT**
  Menu 18 Virtual Standard COM Port DTR: CW Keying
  Menu 19 Virtual Enhanced COM Port RTS: PTT
  Menu 20 Virtual Enhanced COM Port DTR: RTTY Keying

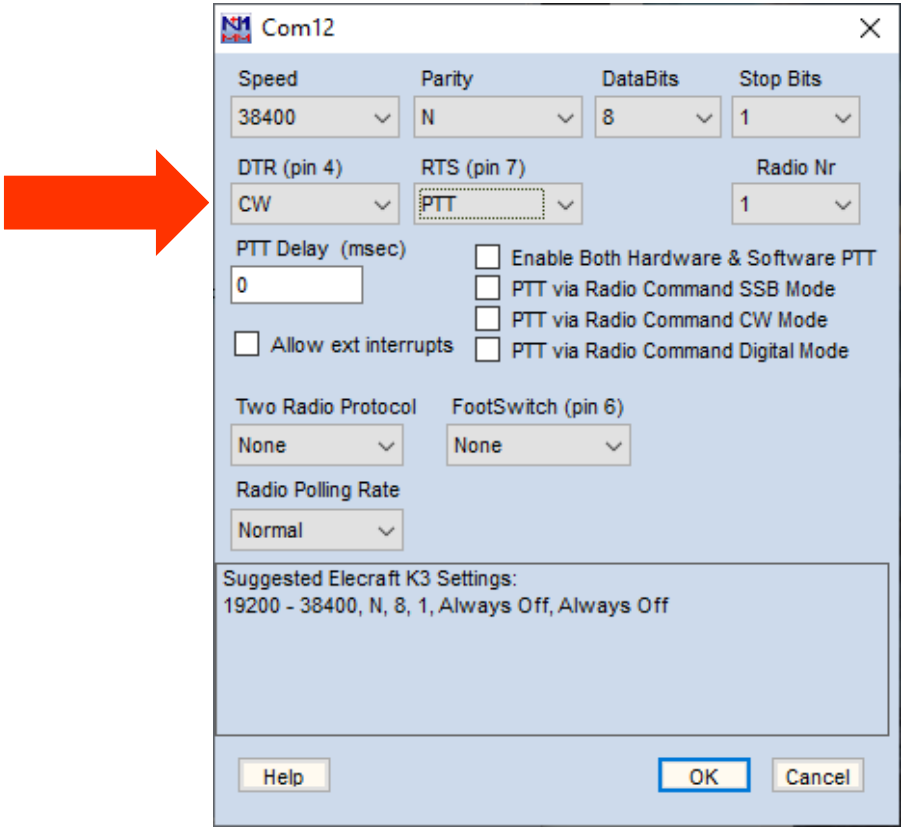
N1MM+ Contest Software

- Open Configurer, view Hardware Tab
- Check CW/Other box next to Rig's Serial Port
- Click Set button



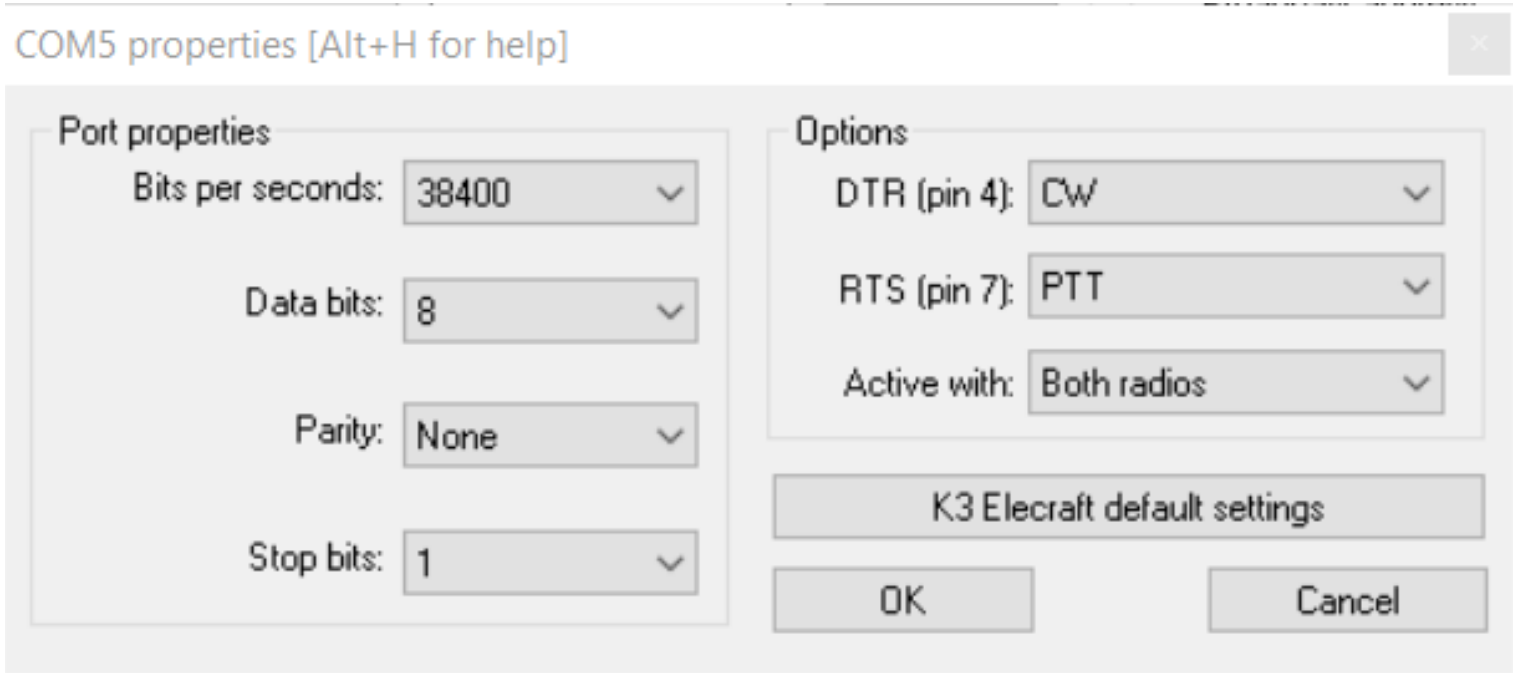
N1MM+ Contest Software

- CW Timing over USB is usually OK!
- Set DTR (pin 4) = CW, RTS (pin 7) = PTT



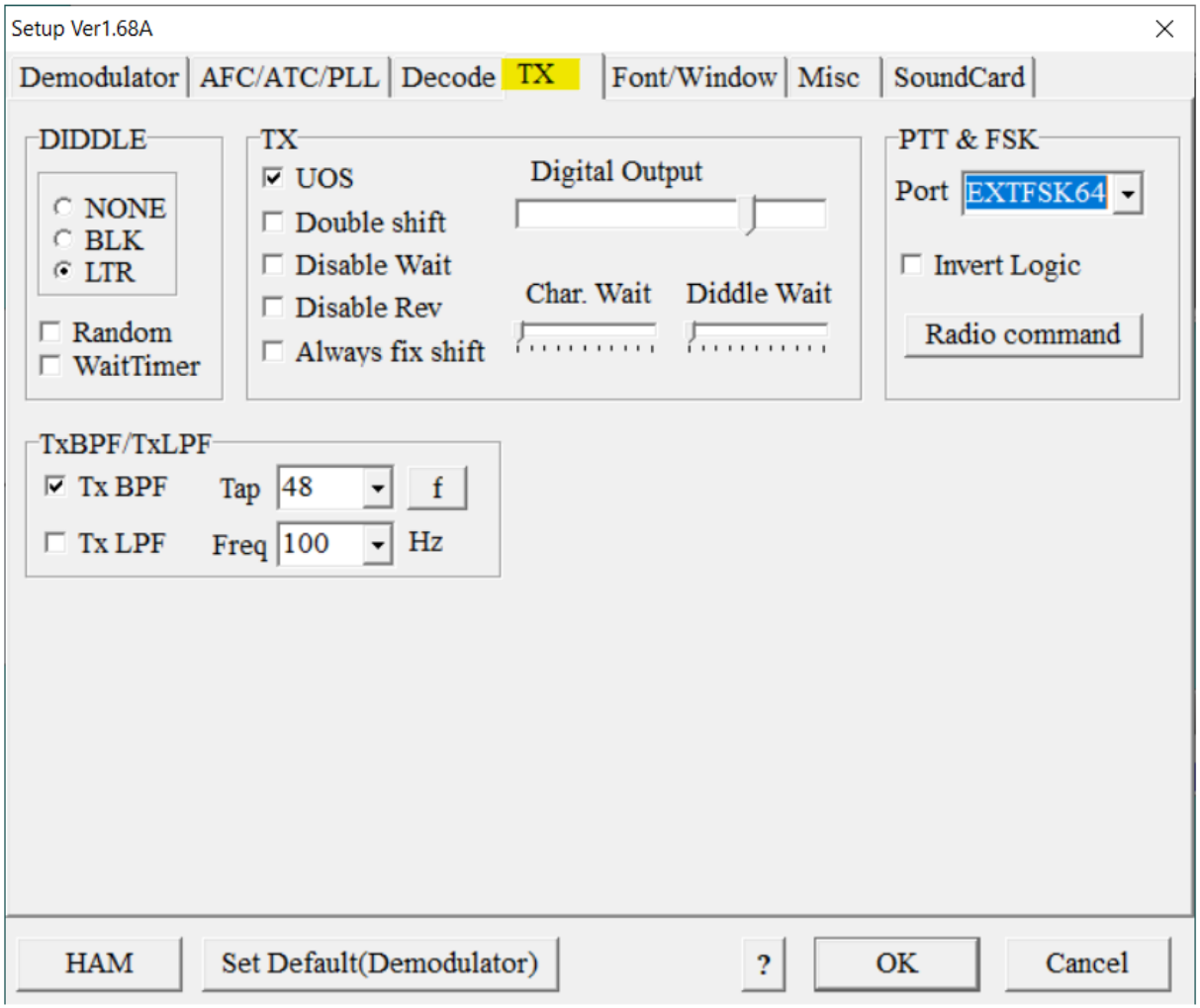
Win-Test Contest Software

- Set DTR (pin 4) = CW, RTS (pin 7) = PTT



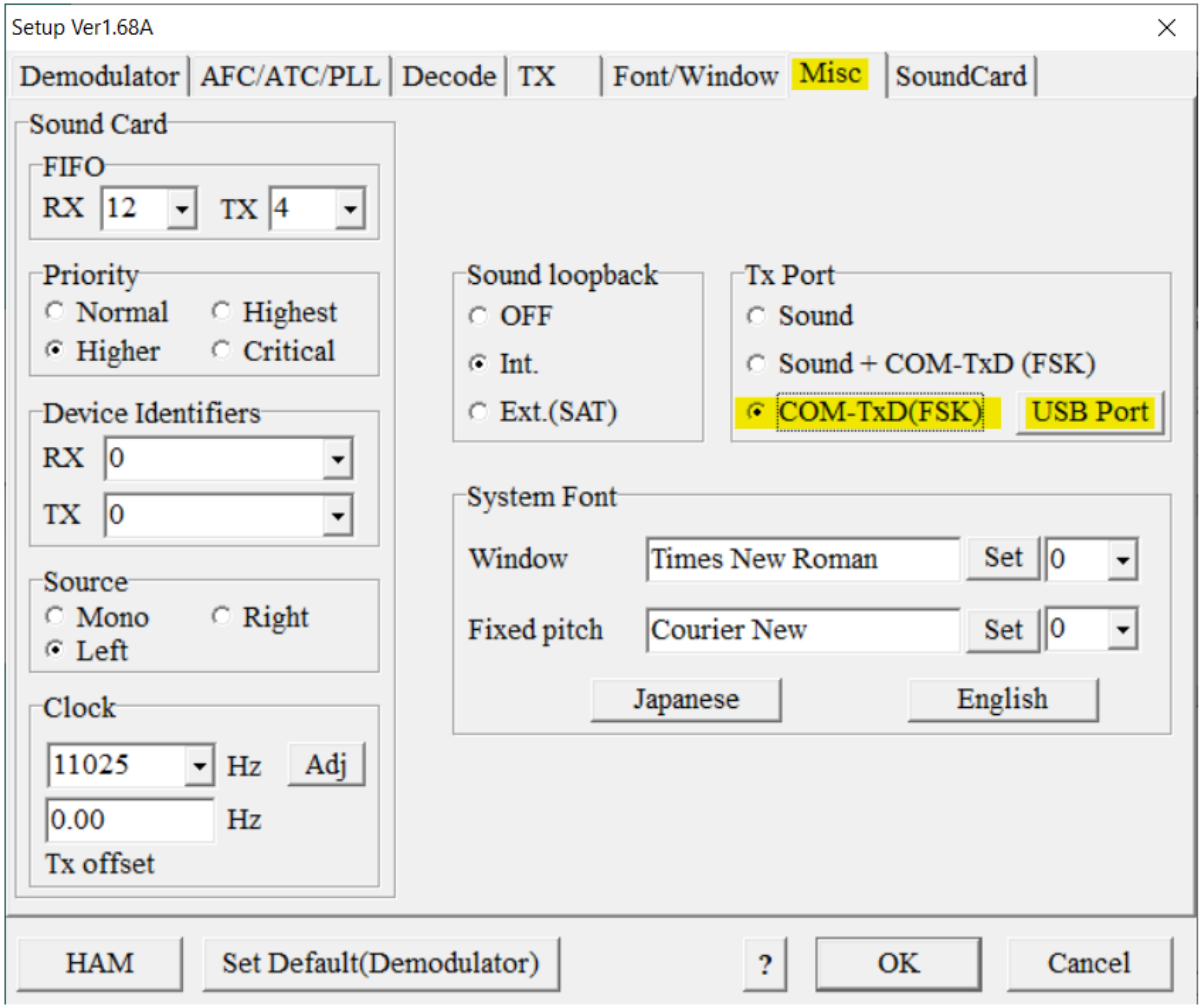
MMTTY Setup Menu, TX Tab

- Set **Port** to **EXTFSK64**



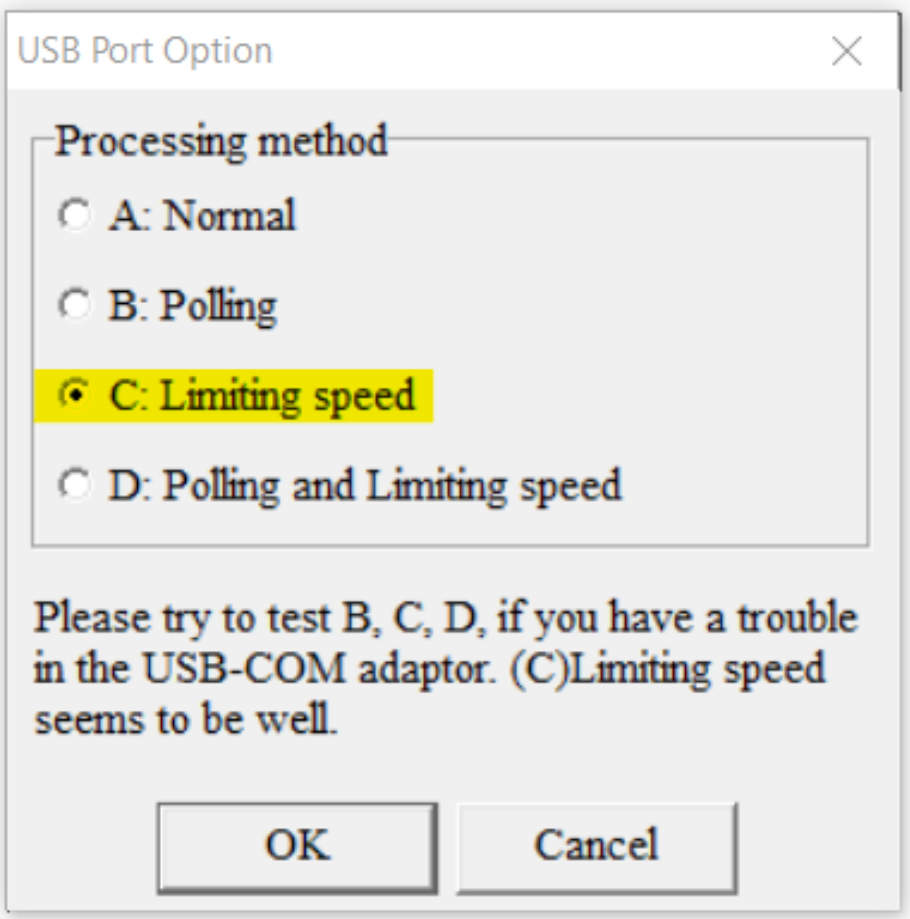
MMTTY Setup Menu, Misc Tab

- Set TX Port to **COM-TxD(FSK)**, click **USB Port**



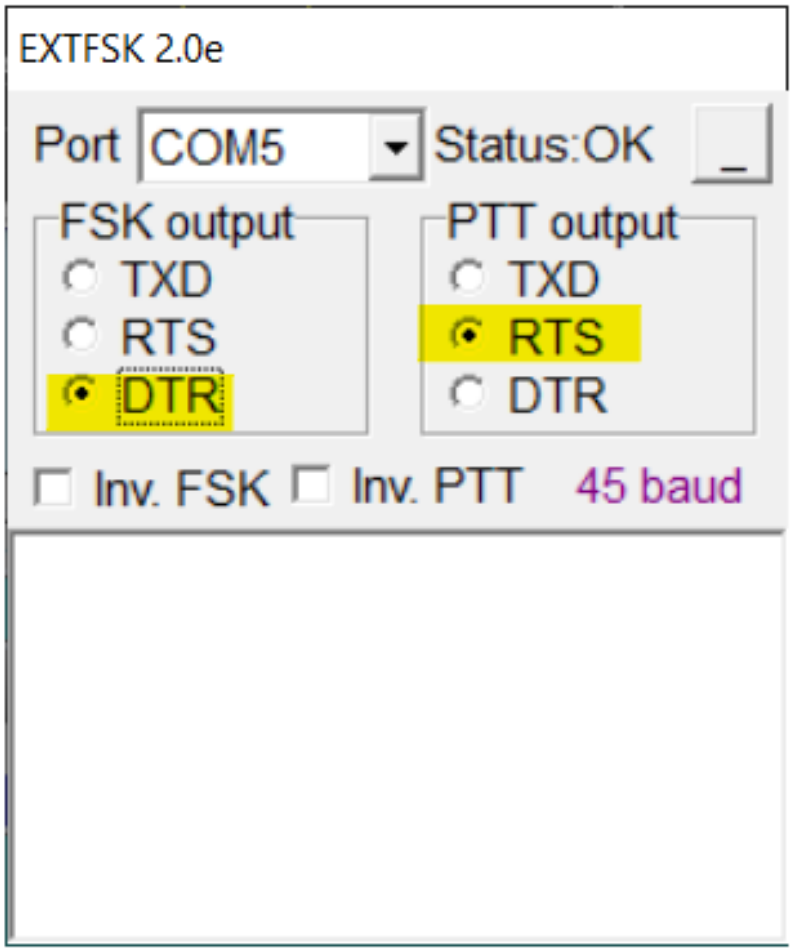
MMTTY USB Port Menu

- Set Processing Method to **C: Limiting Speed**



EXTFSK Pop-Up Menu

- Select second COM Port, FSK=DTR, PTT=RTS



Serial Port Hardware Sharing

- In RS232 protocol, only **one** TXD line (Pin 3) can be connected between a PC and a Radio
- No other device may connect to Pin 3 if a PC is connected
- PC Polls radio on Pin 3 (TXD), Radio sends response on Pin 2 (RXD).
- AUTO INFO mode provides same output without PC polling
- Multiple devices (SteppIR controllers, Band Decoders, Elecraft / ACOM / SPE amplifiers) may *monitor* the RXD line in parallel by only connecting to Pin 2.

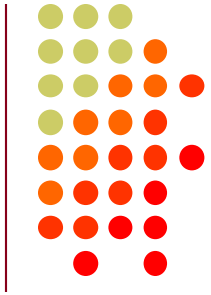
Shameless Plug

- The N6TV “Serial Box” (S-BOX and S-BOX-USB w/FTDI) by N6TV implements parallel connections to RXD pin via standard D-SUB cables:

  https://bit.ly/S-BOX

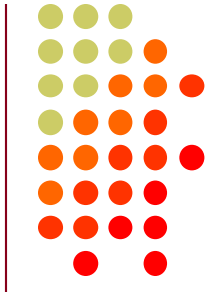
- S-BOXs provide four NPN keying circuits for rigs that do not have any RTS/DTR CW/FSK/PTT keying support (Yaesu FTdx5000, FT-1000MP, Kenwood TS-990s, TS-590s, ICOM IC-7700, IC-7800, etc.)

Serial Port Software Sharing



- Software sharing: multiple programs simultaneously access the radio's rig control serial port
- Implemented by VE3NEA's **OmniRig** software
- OmniRig may be used by Win-Test, Writelog, HDSDR, WJST-X, Log4OM, etc. for rig control
- NOT supported by N1MM+, N3FJP, others
- OmniRig owns the serial port, acts as traffic cop, no collisions or conflicts between applications
- Can I use VSPE instead? Maybe, but collisions / conflicts may occur
- CW / PTT / FSK Keying via OmniRig port not supported

Radios with USB *and* DE-9 connectors

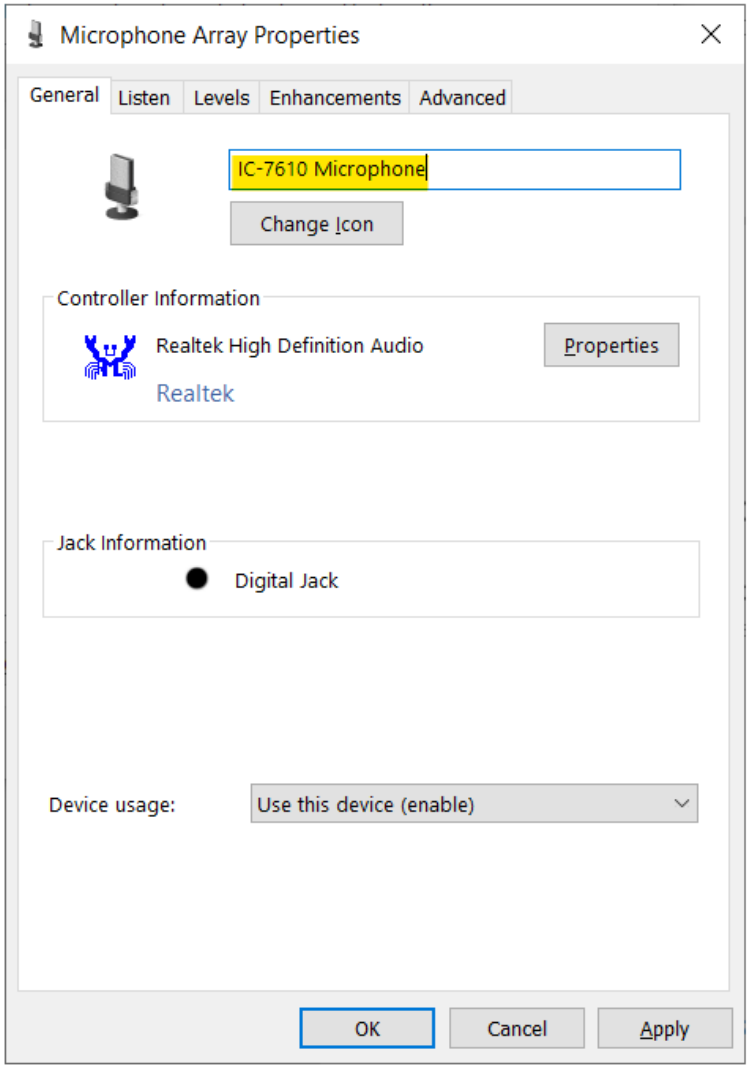


- Elecraft K3: USB and Serial Port (“P3/RS232”) do not operate independently (parallel TXD wiring)
- Kenwood TS-590S and others: USB and Serial Port operate independently
- ICOM USB and CI-V Ports (3.5mm, not DE-9) may operate independently (set **USB CI-V Port** to **Unlink from [REMOTE]**)
- Provides possibility for two programs to poll radio at same time via independent serial ports, one USB, one DE-9 or CI-V.

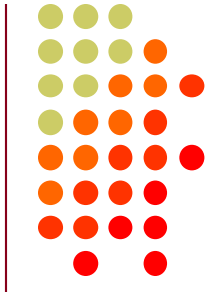
USB connection to radio adds a new Windows Sound Card

- **USB Audio CODEC**
- Can be use for contest recording, voice keying, MMTTY / FT8 decoding
- Multiple “USB Audio CODEC” devices, which is which?
- Right click on Speaker icon, Open Sound Settings
- Scroll down and select **Sound Control Panel**
- Select **USB Audio CODEC** device that appears when you connect USB Cable
- Click **Properties**
- Label both the “Recording” and “Playback” devices

Labeling a USB Audio CODEC Device

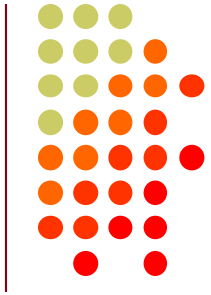


Key Points to Remember



- Set **devmgr_show_nonpresent_devices** to **1**
- Use the Windows Device Manager to manage and renumber COM ports
- Always uninstall Prolific devices and drivers
- Always change the FTDI Default Options
- Try CW, FSK and PTT via serial port pins
- Use DTR for CW/FSK, RTS for PTT
- Understand serial port conflicts and sharing
- Label your USB Audio CODEC devices

Questions?



- http://www.qrz.com/db/n6tv - Links to this and other presentations
- https://www.nirsoft.net/utils/usb_devices_view.html - USB Deview
- https://docs.microsoft.com/en-us/sysinternals/downloads/process-explorer - Windows Process Explorer
- https://bit.ly/S-BOX - The “Serial Box” by N6TV
- n6tv@arrl.net